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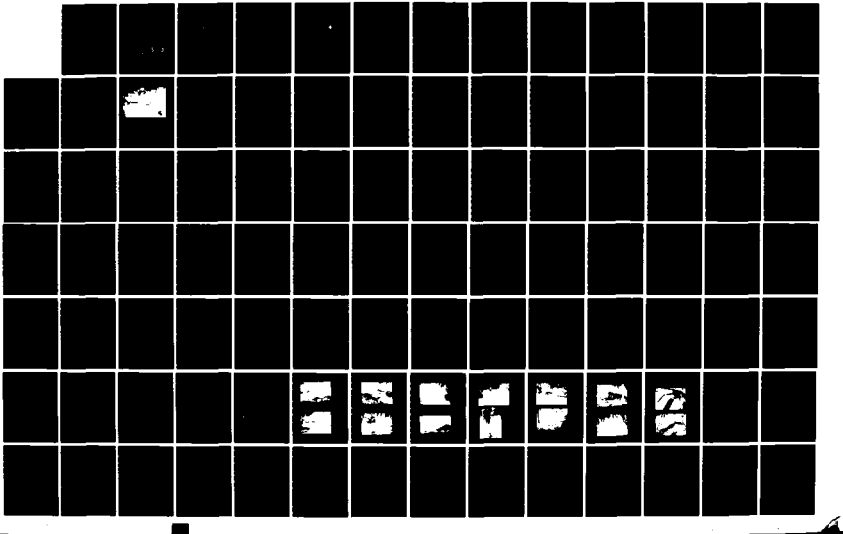

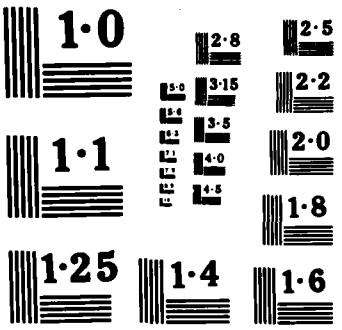

NATIONAL BUREAU OF STANDARDS
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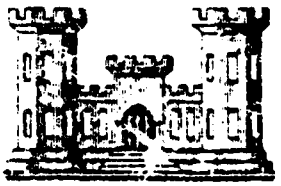
MERRIMACK RIVER BASIN
TEWKSBURY, MASSACHUSETTS

AMES POND DAM

MA. 01006
DIKE A, MA. 01296

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1980

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Merrimack River Basin
Tewsbury, Massachusetts
Meadow Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam consists of a dam, two dikes, a spillway and outlet structures. The dam is about 210 ft. long and 9.7 ft. high. Dike A, an earth embankment dike is located on the east rim of the pond about 700 ft. north of the dam. Failure of the dam or dike would flood several homes and several roadways with the potential for the loss of more than a few lives. It is small in size with a hazard potential of high.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:

NEDED-E

JUN 0 9 1981

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts

Dear Governor King:

Inclosed is a copy of the Ames Pond Dam & Dike (MA-01006 and MA-01296) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Ames Pond Dam & Dike would likely be exceeded by floods greater than 4 percent of the Probable Maximum Flood (PMF). Our screening criteria specifies that a dam of this class which does not have sufficient spillway capacity to discharge fifty percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The term "unsafe" applied to a dam because of an inadequate spillway does not indicate the same degree of emergency as that term would if applied because of structural deficiency. It does indicate, however, that a severe storm may cause overtopping and possible failure of the dam, with significant damage and potential loss of life downstream.

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy precipitation, round-the-clock surveillance should be provided.

NEDED-E
Honorable Edward J. King

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. This report has also been furnished to the owner of the project, Beacon Mortgage, Inc., 1425 Beacon Street, Brookline, Massachusetts 02146.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for the cooperation extended in carrying out this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Commander and Division Engineer

AMES POND DAM

MA 01006

DIKE A MA 01296

MERRIMACK RIVER BASIN
TEWKSBURY, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	MA 01006, MA 01296
Name of Dam:	Ames Pond Dam and Dikes
Town:	Tewksbury
County and State:	Middlesex, Massachusetts
Stream:	Meadow Brook
Date of Inspection:	20 October 1980

BRIEF ASSESSMENT

Ames Pond Dam consists of a dam, two dikes, a spillway and outlet structures. The dam is a composite earth, rock and concrete structure. The dam is about 210 ft. long and 9.7 ft. high. About 50 ft. beyond the right abutment there is a saddle whose low point is 1.2 ft. below the top of dam . The spillway is located near the midpoint of the dam and consists of a two bay broadcrested concrete weir. Each bay is 4.25 ft. long and 3.2 ft. high. A 12 in. dia. cast iron pipe siphon is located just right of the spillway through the right embankment of the dam.The low level outlet is an 18 in. dia. cast iron pipe through the base of the concrete spillway. It is in a deteriorated condition and does not appear to be operative.

Dike A, an earth embankment dike is located on the east rim of the pond about 700 ft. north of the dam. The dike is 210 ft. long and about 11.2 ft. high.

A second earth dike, (DikeB) is located on the east rim of the pond about 400 ft. north of Dike A. It is about 160 ft. long and 5.5 ft. high. It's crest is 2.8 ft. higher than either the Dam or Dike A.

Ames Pond is an impoundment used for recreational purposes. The pond is about 3,200 ft. long and has a surface area of 81 acres at spillway crest level. The drainage area is 1.58 sq. mi. (1,011 acres) and the maximum storage to top of the low point in the saddle on the right abutment is 485 acre-ft.; the size classification is thus small. Failure of the dam or either dike would flood several homes and several roadways with the potential for the loss of more than a few lives. Consequently, the facility has been classified as having a high hazard potential. Based on small size and high hazard, the range for the test flood is ½ PMF to a full PMF. The test flood selected for the project is a ½PMF.

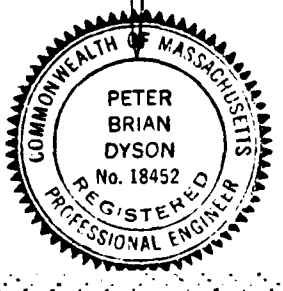
The test flood inflow is 1,230 cfs; the routed test flood outflow of 790 cfs would overtop the low point in the right abutment saddle by 1.7 ft. and the top of the dam by 0.5 ft. The spillway can pass about 61 cfs or about 8 percent of the routed test flood outflow without overtopping the low point in the right abutment.

The facility is judged to be in poor condition. At the time of the inspection there was heavy brush and tree growth on both the dam and dike embankments. The concrete in the spillway was in poor condition. There was seepage through the spillways downstream training walls and also at the downstream toe of Dike A. The low level outlet does not appear to be operative.

Within one year after receipt of this Phase I Inspection Report, the owner, Beacon Mortgage, Inc., should retain the services of a registered professional engineer and implement the results of his evaluation of the following: (1) perform a detailed hydrogolic and hydraulic analysis to further assess the need for and means to increase the project discharge capacity; (2) determine the feasibility of raising the embankment and the saddle in the reservoir rim; (3) investigate the seepage through the spillway's downstream training walls; (4) recommend methods of repair of the spillway; (5) investigate the wet area at the downstream toe of Dike A; (6) investigate the need for bedding and riprap on the upstream slopes of the dam and dike embankments; (7) investigate the tilting of the concrete wall on the dam's left embankment; (8) investigate the feasibility of either repairing the low level outlet or providing another means for draining the pond in the event of an emergency; (9) conduct a seismic investigation and analysis by conventional equivalent static load methods; and (10) remove all trees (greater than 4 in.) including root systems from the crest, slopes and within 10 ft. of the toe of the dam and dikes and backfill with suitable compacted material.

The owner should also implement the following operating and maintenance measures; (1) repair erosion of the slopes at the intersection of the dam embankments with the concrete spillway structure; (2) institute an annual technical inspection program for the dam and appurtenant structures; (3) develop a formal surveilance and "Emergency Action Plan" including round-the-clock monitoring during periods of heavy precipitation; (4) implement a regular periodic maintenance program; and, (5) remove all small trees (less than 4 in. dia.) and brush growth from all embankments and within 10 ft. of the toe of all embankments.

Peter B. Dyson
Project Engineer



INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(1) IDENTITY NUMBER	(1) DIVISION	(1) STATE	(1) COUNTY	(1) CONGR DIST.	(1) STATE	(1) COUNTY	(1) CONGR DIST.	(1) NAME	(10) LATITUDE (NORTH)	(10) LONGITUDE (WEST)	(10) REPORT DATE DAY | MO | YR
MA	1006	NED	MA	009	05				AMES POND DAM	4238.0	7113.5	20OCT80

(11) POPULAR NAME	(12) NAME OF IMPOUNDMENT
	AMES POND

(13) REGION	(14) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	09	MEADOW BROOK	TEWKSBURY	20	22800

(7) TYPE OF DAM	(16) YEAR COMPLETED	(15) PURPOSES	(9) STRUCTURAL HEIGHT (FT.)	(8) HYDRAULIC HEIGHT (FT.)	(8) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(8) IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)
REPG	1920	R	10	10	685	350

DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
	NED	N	N	N	N

(21) REMARKS

(28) D/S HAS	(29) SPILLWAY CNC–ST LENGTH	(31) SPILLWAY TYPE	(32) SPILLWAY WID FT (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) POWER CAPACITY PROPOSED (MW)	(37) NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	209	U	10	60	840											

(22) OWNER	(23) ENGINEERING BY	(24) CONSTRUCTION BY
BEACON MORTGAGE, INC.	UNKNOWN	UNKNOWN

(25) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	MA DEQE	MA DEQE

(26) INSPECTION BY	(27) INSPECTION DATE DAY | MO | YR	(30) AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOC INC	20OCT80	PL 92-367

(38) REMARKS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(1) IDENTITY NUMBER	(1) DIVISION	(2) STATE	(3) COUNTY	(4) CONGR DIST	(5) STATE	(6) COUNTY	(7) CONGR DIST.	(8) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
25	00296	NED	MA	009	05				AMES POND DIKE A	4236.0	7113.3	20	OCT	80

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
	AMES POND

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	09	MEADOW BROOK	TEWKSBURY	2	22800

(9) TYPE OF DAM	(10) YEAR COMPLETED	(11) PURPOSES	(12) STRUCTURAL HEIGHT (FT.)	(13) HYDRAULIC HEIGHT (FT.)	(14) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	NORMAL (ACRE–FT.)
PEPG	1920	R	11	11	485	350

DIST	OWN	FED R	PRVFED	SCS A	VER/DATE
NED	N	N	N	N	

(15) REMARKS
L

(19) D/S HAS	(20) SPILLWAY CREST LENGTH	TYPE	WID (FT.)	(21) MAXIMUM DISCHARGE (FT.)	(24) VOLUME OF DAM (CY)	(25) POWER CAPACITY INSTALLED (MW)	PROPOSED (MW)	(31) NO	NAVIGATION LOCKS (32) LENGTH (FT.)	(33) WIDTH (FT.)	(34) LENGTH (FT.)	(35) WIDTH (FT.)	(36) LENGTH (FT.)	(37) WIDTH (FT.)	(38) LENGTH (FT.)	(39) WIDTH (FT.)
1	210				1100											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
BEACON MORTGAGE, INC.	UNKNOWN	UNKNOWN

(49) REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	MA DEQE	MA DEQE

(50) INSPECTION BY	(51) INSPECTION DATE DAY	MO	YR	(52) AUTHORITY FOR INSPECTION
LOUIS BERGER & ASSOC INC	20	OCT	80	PL 92-367

(53) REMARKS

PREFACE

his report is prepared under guidance contained in the Recommended Guidelines or Safety Inspection of Dams, for Phase I Investigations. Copies of these uidelines may be obtained from the Office of Chief of Engineers, Washington, .C. 20314. The purpose of a Phase I Investigation is to identify expeditiously ose dams which may pose hazards to human life or property. The assessment of he general condition of the dam is based upon available data and visual inspec-ions. Detailed investigation, and analyses involving topographic mapping, sub-urface investigations, testing, and detailed computational evaluations are be-ond the scope of a Phase I investigation; however, the investigation is intended o identify any need for such studies.

n reviewing this report, it should be realized that the reported condition of he dam is based on observations of field conditions at the time of inspection long with data available to the inspection team. In cases where the reservoir as lowered or drained prior to inspection, such action, while improving the tability and safety of the dam, removes the normal load on the structure and ay obscure certain conditions which might otherwise be detectable if inspected nder the normal operating environment of the structure.

t is important to note that the condition of a dam depends on numerous and con-tantly changing internal and external conditions, and is evolutionary in nature. t would be incorrect to assume that the present condition of the dam will con-inue to represent the condition of the dam at some point in the future. Only hrough continued care and inspection can there be any chance that unsafe con-itions be detected.

hase I inspections are not intended to provide detailed hydrologic and hydraulic nalyses. In accordance with the established Guidelines, the Spillway Test Flood s based on the estimated "Probable Maximum Flood" for the region (greatest easonably possible storm runoff), or fractions thereof. Because of the magni-ude and rarity of such a storm event, a finding that a spillway will not pass he test flood should not be interpreted as necessarily posing a highly inade-uate condition. The test flood provides a measure of relative spillway capa-ity and serves as an aide in determining the need for more detailed hydrologic nd hydraulic studies, considering the size of the dam, its general condition nd the downstream damage potential.

he Phase I Investigation does <u>not</u> include an assessment of the need for fences, ates, no-trespassing signs, repairs to existing fences and railings and other tems which may be needed to minimize trespass and provide greater security for he facility and safety to the public. An evaluation of the project for com-liance with OSHA rules and regulations is also excluded.

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SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General. The visual inspection of Ames Pond Dam took place on 20 October 1980. At that time the water level in the pond was about 0.2 ft. below the spillway crest and no water was flowing out of the pond. Seepage was noted to be coming out of cracks in the downstream spillway training walls and seepage was noted at the toe of Dike A. Tree and brush growth was abundent on both the dam and the dikes. The vertical alignment of the dam is poor and the crest has an exposed granular surface. On the basis of the Phase I visual examination the physical condition of Ames Pond Dam appears to be generally poor.

b. Dam. Ames Pond Dam is a composite earth, concrete and rock structure but is predominately constructed of earth. The dam is about 210 ft. long and is about 9.7 ft. high. The dam has a centrally located spillway facility and is flanked by earth embankments. The crest of the dam is about 12 ft.wide and the downstream slope is about 1½ horizontal to 1 vertical. The upstream slope is irregular. There is a concrete wall on the downstream side of the crest of the left embankment and its top is flush with the embankment crest. Large random rocks have been dumped on both embankments (photo nos. 1,2 and 3, Appendix C).The vertical alignment of the dam is poor and there is tree and brush growth on the embankments.

The concrete wall extends along the entire length of the left embankment. It is deteriorated and is tilting about 30° from the vertical in the downstream direction (photo no. 4 appendix C). The depth of the wall is unknown.

The left and right embankments are irregular in shape but have average downstream slopes of about 1½ horizontal to 1 vertical. There is evidence of trespassing on the slopes and erosion at the intersection of the embankments with the concrete spillway. There is no evidence of seepage through either the left or right embankment. The oversized boulders placed on the upstream slope have no bedding and are of little value as riprap.

There is a topographic low saddle on the reservoir rim beyond the right embankment. The low point of the 95 ft. long saddle is about 1.2 ft. below the crest of the dam and about 1.5 ft. above the spillway crest. During high pond levels, water will discharge through this saddle and into Meadow Brook, before overtopping the crest of the dam. (see photo no. 5).

SECTION 2 - ENGINEERING DATA

2.1 Design Data

No data on the design of the dam or appurtenances has been recovered and probably none exists. In the course of the inspection, some measurements were taken and a sketch plan and profile layout of Ames Pond Dam, Dikes and appurtenances was prepared, which is included in Appendix B.

2.2 Construction Data

No records or correspondence regarding construction have been found.

2.3 Operation Data

No engineering operational data were disclosed.

2.4 Evaluation of Data

a. Availability. There was no engineering data available. The basis of the evaluation presented in this report is principally the visual observations of the inspection team.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed form the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Validity. Not applicable.

Dike A

(1) Invert - 139.5±

(2) Size - 2 ft. high by 3.5 ft. wide

(3) Description - Concrete box culvert

(4) Control Mechanism - None visible

(5) Other - Does not appear to be operative

Dike "B"

(1) Type - earth embankment

(2) Length - 160 ft.

(3) Height - 5.5 ft.

(4) Top Width - 14 ft.

(5) Side Slopes - U.S. 1 horizontal to 1 vertical
D.S. 1 horizontal to 1 vertical

(6) Zoning - unknown

(7) Impervious Core - unknown

(8) Cutoff - unknown

(9) Grout curtain - unknown

h. Division and Regulating Tunnel - Not applicable

i. Spillway

(1) Type - 2 - concrete weirs
1 - 12" dia. siphon pipe

(2) Length of weir 2 @ 4.25 ft. (Total 9.5 ft.)

(3) Crest elevation - 148.0

(4) Gates - None

(5) U/S Channel - pond

(6) D/S Channel - Natural stream

j. Regulating Outlets (not operational)

Main Dam

(1) Invert - 141.7

(2) Size - 18 in. dia.

(3) Description - cast iron pipe

(4) Control Mechanism - none visible

(5) Other - there appears to be an old stop log structure at inlet end which has deteriorated and is now plugged.

e. Storage (acre-feet)

(1) Normal pool - 350

(2) Flood control pool - Not Applicable

(3) Spillway crest pool - 350

(4) Top of right abutment - 485

(5) Top of dam wall - 610

(6) Test Flood pool - 664

f. Reservoir Surface (acres)

(1) Normal pool - 81

(2) Flood-control pool - Not Applicable

(3) Spillway crest - 81

(4) Top of right abutment - 98.5

(5) Top of dam wall - 109

(6) Test flood pool - 112

g. Dam		Dike "A"
(1)	Type - Composite, earth, rock and concrete.	Earth embankment
(2)	Length - 209 ft.	210 ft.
(3)	Height - 9.7 ft.	11.2 ft.
(4)	Top Width - 12 ft.	9 ft.
(5)	Side Slopes - U.S.-1½ horiz. to 1 vert. D.S.-1½ horiz. to 1 vert.	averages 1 U.S.-varies, horiz. to 1 ve D.S. 1½ horizontal to 1 ver
(6)	Zoning - unknown	unknown
(7)	Impervious Core - unknown	unknown
(8)	Cutoff - unknown	unknown
(9)	Grout curtain - unknown	unknown

(7) Total Spillway Capacity at Test Flood Elevation. The total spillway capacity at the test flood elevation is the same as (4) above, 165 cfs at elevation 151.2.

(8) Total Project Discharge at Top of Dam. Since the low level outlet is not operational, the total project discharge when the water level is at the top of the right abutment is the same as (3) above, 61 CFS at elevation 149.5 and 131 cfs at elevation 150.7, top of dam.

(9) Total Project Discharge at Test Flood Elevation. The total project discharge at test flood elevation 151.2 is 790 CFS.

c. Elevation (ft. N.G.V.D. Assumed From U.S.G.S. Map)

(1) Streambed at toe of dam - 141.0

(2) Bottom of cutoff - unknown

(3) Maximum tailwater - unknown

(4) Normal pool - 148.0

(5) Full flood control pool - Not Applicable

(6) Spillway crest - 148.0

(7) Design surcharge (Original Design) - unknown

(8) Top of right abutment - 149.5

(9) Top of dam wall - 150.7

(10) Top of Dike A -150.7

(11) Top of Dike B - 153.5

(12) Test flood surcharge - 151.2

d. Reservoir (Length in feet)

(1) Normal pool - 3,200

(2) Flood control pool - Not Applicable

(3) Spillway crest pool - 3,200

(4) Top of dam wall - 3,300

(5) Test flood pool - 3,400

h. Design and Construction History. It is not known by whom the dam was designed and constructed. According to records the dam was built originally as part of the Ames Estate and the pond was used for sport fishing. It is believed the dam was constructed around 1920. Records indicate an application to alter the dam was submitted to the Massachusetts Department of Public Works in December 1978. However, at the time of the inspection it did not appear that any recent alterations had been made to the dam.

i. Normal Operating Procedure. There are no known operating procedures for Ames Pond Dam. The existing low level outlet facility does not appear to be operative.

1.3 Pertinent Data

a. Drainage Area. The drainage area contributing to Ames Pond is situated at the headwaters of Meadow Brook. The drainage area encompasses a total of about 1.58 sq. mi., (1,011 acres), The pond has a surface area of 81 acres. The longest circuitous stream course leading to the dam is about 2.4 miles long with an elevation difference of about 112 ft., or at a slope of about 46 ft. per mile. The drainage area has a length of about 1.9 miles and an average width of about 1 mile. The basin consists of forested areas, open fields, and urban developemnt, but is predominately forested. Interstate Route 495 traverses the watershed about 1,000 ft. upstream of the pond. The topography can best be described as rolling terrain. The drainage area rises from elevation 148 at normal pool to elevation 260.

b. Discharge at Damsite.

(1) Outlet Works Conduit. The low level outlet at Ames Pond Dam does not appear to be operative. However, it is estimated the 18 in. outlet pipe would be capable of discharging about 25 CFS if wide open and the water surface level was at top of the right abutment.

(2) Maximum Know Flood at Damsite. No records are available of flood inflows into Ames Pond, nor of spillway releases and surchage heads during such inflows.

(3) Ungated Spillway Capacity at Top of Dam. The total spillway capacity at top of right abutment, elevation 149.5 is 61 cfs and at top of dam, elevation 150.7 is 131 cfs.

(4) Ungated Spillway Capacity at Test Flood Elevation. The ungated spillway capacity is about 165 cfs at test flood elevation 151.2.

(5) Gated Spillway Capacity at Normal Pool Elevation. Not applicable.

(6) Gated Spillway Capacity at Test Flood Elevation. Not applicable:

c. Size Classification. Ames Pond Dam is about 9.7 ft. above downstream stream level, impounding a maximum of about 350 acre-ft. of storage to spillway crest level and about 485 acre-ft. to the top of a low point in the right abutment. In accordance with height and storage capacity criteria given in Recommended Guidelines For Safety Inspection of Dams the project is classified as small in size. A small size dam is one which has a height less than 25 ft. and a storage capacity greater than 50 acre-ft. but less than 1,000 acre-ft.

d. Hazard Classification. It is estimated a breach failure of either the dam or dikes at Ames Pond would result in flooding of homes and roadways.

A breach failure of the dam would flood three houses located about 500 ft. below the dam to depths of about 2 ft. to 3 ft. Near Pinnacle St. it is estimated one house would be subject to about 2 ft. of flooding and a commercial garage would receive about 1 ft. of flooding. In addition to Kendall St. and Pinnacle St. being flooded, East St. and Shawsheen St. both located further downstream would be overtopped. No flooding along the reach would occur due to the prefailure spillway discharge.

Immediately below Dike A there is a relatively new housing development. It is estimated four houses located in this development would be flooded to depths ranging from 2 to 3 ft. due to a breach of Dike A. Further downstream along Kendall St., it is estimated 4 houses would be flooded to depths of about 3.5 ft. In addition to the houses being flooded, three local streets would be flooded. Beyond Kendall St. flows would return to Meadow Brook.

A breach of Dike B would inundate the same downstream area as Dike A but to a substantially less degree.

In accordance with the Recommended Guidelines for Safety Inspection of Dams, Ames Pond Dam has been classified as having a high hazard potential, since failure of the dam or dikes would cause serious damage to homes, a commercial establishment and local roadways, with the potential for the loss of more than a few lives.

e. Ownership. Ames Pond Dam is owned by the Beacon Mortgage, Inc. 1425 Beacon St., Brookline, MA 02146. Tele: 617-232-7850.

An Engineering Report shown in Appendix B indicates the facilities were first owned by the Ames Estate.

f. Operator. Mr. James Boyle, Beacon Mortgage, Inc. 1425 Beacon St., Brookline, MA 02146. Tele: 617-232-7850.

g. Purpose of Dam. The dam impounds a pond used for recreational purposes.

b. Description of Dam and Appurtenances

(1) Description of Dam. Ames Pond Dam is a composite, earth, concrete and rock structure. The dam is about 210 ft. long and about 9.7 ft. high. The crest of the dam is about 12 ft. wide and the downstream slope is about 1½ horizontal to 1 vertical. The upstream slope is irregular. The majority of the dam is constructed of earth. There is a concrete wall on the downstream side of the crest of the left embankment. The top of the wall is flush with the dam crest. There are large random dumped rocks on both left and right embankments. The rim of the pond just to the right of the dam has a saddle, which leads to Meadow Brook. It is about 1.2 ft. lower than the top of the dam.

(2) Dike A. Dike A is an earth embankment about 210 ft. long and 11.2 ft. high. It is located on the east rim of the reservoir about 700 ft. north of the dam. The dike has a crest width of about 9 ft. and a downstream slope of 1½ horizontal to 1 vertical. The upstream slope is variable but averages about 1 horizontal to 1 vertical. An old outlet structure passes through the dike near the right abutment. The culvert is about 2 ft. high and 3.5 ft. wide. The outlet culvert is plugged with earth on the upstream side and there are no visible controls for the structure.

(3) Dike B. Dike B is an earth embankment about 160 ft. long and 5.5 ft. high. It is located on the east rim of the reservoir about 400 ft. north of Dike A. The dike has a crest width of about 14 ft. and a downstream slope of 1 horizontal to 1 vertical. The upstream slope is about 1 horizontal to 1 vertical. The crest of the dike is 2.8 ft. higher than the crest of both the Dam and Dike A. The dike is constructed across a natural swale on the rim of the pond. It's upstream toe is slightly above the water surface at normal pool level.

(4) Spillway. The spillway is located near the midpoint of the dam. The spillway facility consists of a two bay broadcrested concrete weir 4.25 ft. long and 3.2 ft. high and a 12 in. dia. cast iron pipe siphon. The siphon is located just to the right of the spillway. The two bays are separated by a concrete column about 4.5 ft. wide.

(5) Low Level Outlet. The low level outlet at the dam does not appear to be operative. It is an 18 in. dia. cast iron pipe through the base of the concrete spillway. The outlet invert in located 9 ft. below the top of dam. The length of the pipe is unknown and there appears to be no existing outlet control. There is a deteriorated stoplog structure on the upstream side of the concrete spillway which at one time may have served as the controls for the low level outlet. The outlet pipe is either closed or plugged.

PHASE I INSPECTION REPORT

AMES POND DAM MA 01006

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Louis Berger & Associates, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Louis Berger & Associates, Inc. under a letter of 15 October 1980 from William E. Hodgson, Jr., Colonel, Corps of Engineers. Contract No. DACW33-80-C-0043, Job Change No. 2 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

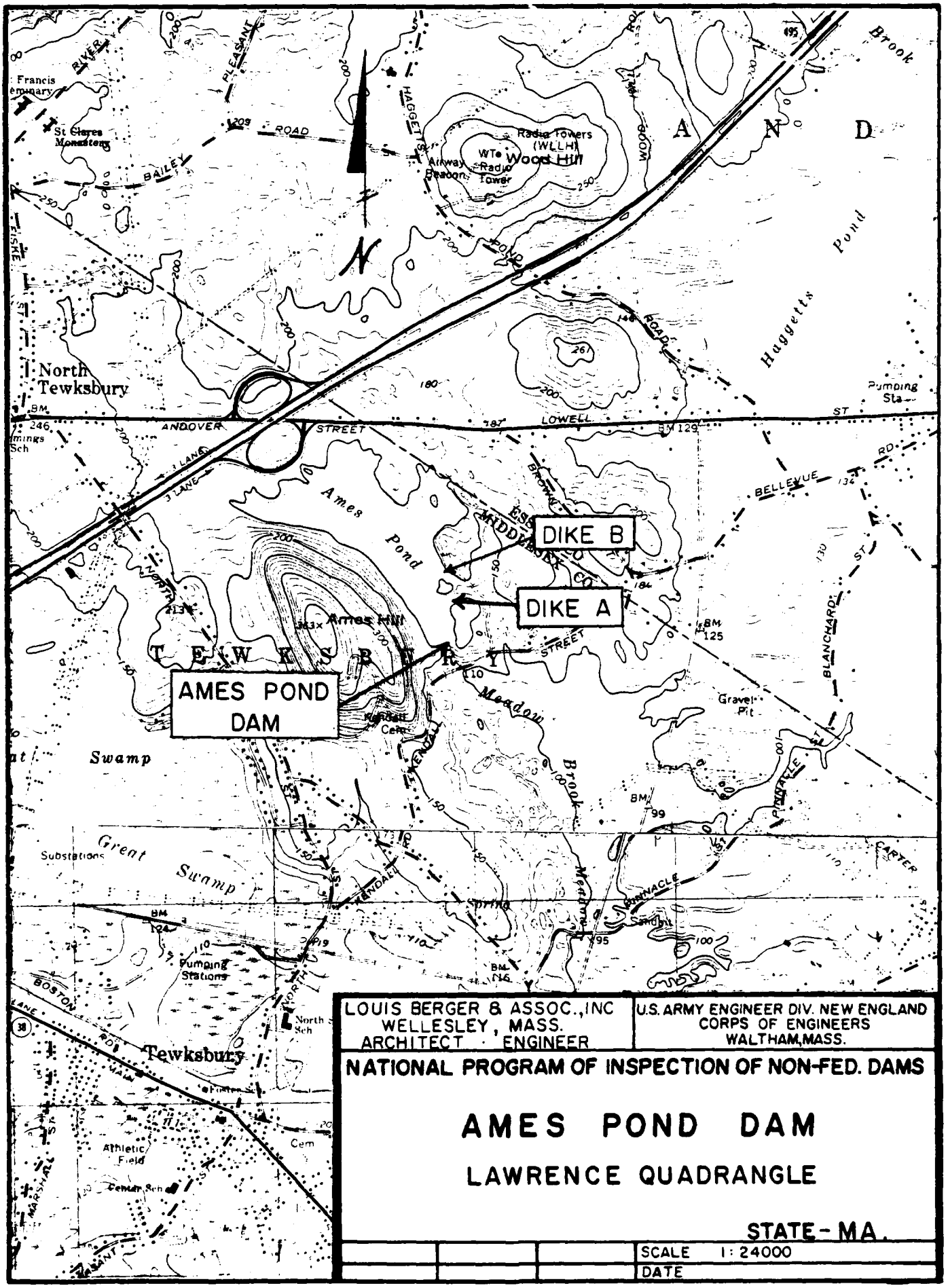
(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which treaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Ames Pond Dam is located in Middlesex County in the Town of Tewksbury, Massachusetts. The dam is situated at the headwaters of Meadow Brook which joins the Shawsheen River at a point about 3.2 miles below the dam. The Shawsheen River joins the Merrimack River about 14 miles downstream of the dam. Ames Pond Dike A is located about 700 ft. north of the dam on the east rim of the pond and Ames Pond Dike B is located about 400 ft. north of Dike A. The dam is just north of Kendall St. and is shown on U.S.G.S. Quadrangle Lawrence, Mass.-N.H., with coordinates approximately at N 42° 37' 58", W 71° 13' 16".



LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

AMES POND DAM

LAWRENCE QUADRANGLE

STATE - MA.

			SCALE 1:24000
			DATE

AMES POND DAM

OVERVIEW PHOTO

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c. Appurtenant Structures. The spillway is located near the midpoint of the dam. The primary spillway is a concrete structure consisting of two broadcrested concrete weirs each 4.25 ft. long and separated by a 4.5 ft. long concrete column. The walls of the weir are about 3.2 ft. high. Photo no. 6 shows the upstream side of the concrete spillway. A 12 in. dia. cast iron pipe passes through the right embankment and serves as a siphon spillway. Photo no. 7 is a view of the downstream face of the concrete spillway. The right downstream training wall is broken and spalled and clear, clean seepage is issuing from the deteriorated concrete (see photo no. 8) The seepage through the right training wall is estimated to be about 0.1 gpm. Seepage was also noted in the right training wall to a lesser degree. The concrete spillway is in generally poor condition. The auxilliary siphon spillway appeared to be in fair condition but it could not be ascertained if its inlet end was open or plugged.

Dike A, one of the dikes, is located on the east rim of the pond about 700 ft. north of the dam. The dike is an earth embankment about 210 ft. long and 11.2 ft. high. The crest of the dike is about 9 ft. wide and the downstream slope is about 1½ horizontal to 1 vertical. The upstream slope is irregular. Photo no. 9 shows the considerable light tree growth on the upstream slope and the remains of an old and apparently plugged outlet structure. There is no slope protection on the upstream slope. There is extensive erosion and trespassing at its intersection with the concrete outlet structure. The approximately 1½ horizontal to 1 vertical downstream slope of the dike shows signs of erosion and there are some large trees growing on the downstream slope. An approximately 30 feet square wet area was noted along the downstream toe of the dike. Seepage was clear and estimated to be about 2 to 4 gpm through this area. (See photo no. 10, 13 & 14, Appendix C).

The concrete outlet structure at the dike is in generally good structural condition, but is plugged at its inlet. Because of a new housing development downstream of the dike the outlet structure no longer has a useful purpose.

Dike B is located on the east rim of the pond about 400 ft. north of Dike A. The dike is an earth embankment about 160 ft. long and 5.5 ft. high. The crest of the dike is about 14 ft. wide and the upstream and downstream slopes are about 1 horizontal to 1 vertical (see photo nos. 11 & 12, App. C). The crest elevation is 2.8 ft. higher than the crest elevations of both the Dam and Dike A. The dike spans a natural swale and the water surface of the pond is below the upstream toe of the dike when the pond's pool is at spillway crest level. There is no slope protection on the upstream slope and the crest of the dike showns signs of trespassing. Minor erosion appears on the upstream slope. There is vegetation growth near the upstream slope between the dike and the pond.

The low level outlet at the dam does not appear to be operative. It is an 18 in. dia. cast iron pipe through the base of the concrete spillway. The outlet end invert is located 9 ft. below the top of dam. The length of the pipe is unknown and there appears to be no existing outlet control. There is a deteriorated stoplog structure on the upstream side of the concrete spillway and at one time it may have served as the control for the low level outlet. The outlet pipe is either closed or plugged. Some seepage from the pipe was noted, estimated to be 0.5 gpm.

d. Reservoir Area. The shorelines upstream of the dam on both the right and left abutments appear stable with no evidence of landslides or sloughing. The left rim of the pond has mild slopes and the right rim has generally steep slopes. Numerous houses are located on the southerly rim of the pond.

e. Downstream Channel. Immediately below the dam the spillway discharges into a relatively narrow and steep channel which extends about 500 feet to Kendall St. where two 7.0 ft. by 5.1 ft. corrugated metal pipe arches serve as a culvert. Beyond Kendall St. Meadow Brook wanders through a large swampy area for a distance of about one mile. Beyond the swamp the brook meanders gently through a rural part of Tewksbury until reaching the vicinity of the Shawsheen River, where urban development is present.

3.2 Evaluation

The visual inspection adequately revealed key characteristics of the dam as they may relate to its stability and integrity. The dam and appurtenant works were judged to be in poor physical condition. Seepage was noted in both downstream spillway training walls. The spillway concrete is in a deteriorated condition. The low level outlet does not appear to be operative. There is no adequate rip rap protection on the upstream slopes of the dam or dikes. The concrete wall on the left embankment is severly tilted. There is seepage at the toe of Dike A and both the dam and dikes have abundant brush and tree growth on them. The saddle in the right abutment is lower than the top of the dam, and there is no indication of a periodic maintanance program at the facility.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Operating Procedures

a. General. The dam is owned and operated by Beacon Mortgage, Inc. The impoundment is used for recreational purposes, but there are no devices in operating condition for controlling levels of the pond.

b. Description of Any Warning System in Effect. No warning system is in effect at Ames Pond Dam.

4.2 Maintenance Procedures

a. General. There is no documented regular periodic maintenance program in effect at Ames Pond Dam, nor does it appear that any recent maintenance has taken place. There are, however, several items which require periodic maintenance, such as: growth removal from the embankments; repair of the spillway training walls and surveillance of the downstream slopes regarding seeps and animal burrows.

b. Operating Facilities. The low level outlet for the dam shows no sign of maintenance in recent years and is now believed to be inoperative. The stoplog structure is deteriorated and cannot accommodate stoplogs and an old conduit through Dike A has been plugged.

4.3 Evaluation

Overall maintenance of the dam and dikes is poor. General maintenance should involve periodic growth removal from the embankments, surveillance regarding seeps, slope damage and animal burrows etc., maintenance of the low level outlet, and repair of the concrete spillway.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. Ames Pond Dam is an earth embankment spanning the outlet to Ames Pond. Two earth dikes are located on the east rim of the pond about 700 ft. and 1100 ft. north of the dam respectively. The embankments impound a normal storage of about 350 acre-ft. with provisions for an additional 135 acre-ft. of capacity in its surcharge space to the top of the low point in the saddle in the right abutment. The project is basically a low surcharge-low spillage facility used for recreational purposes. The spillway facility consists of two concrete weirs and a 12 in. dia. cast iron pipe siphon which combined are capable of discharging about 61 CFS with the surcharge to the low point in the right abutment. The general topographic features of the 1.58 sq. mi. drainage area is best described as rolling terrain. The drainage area measures about 1.9 miles long, has an average width of about 1 mile, and rises from elevation 148 ft. at spillway crest level to elevation 363. The area contains open fields, forested areas, and urban areas, but is generally forested. Interstate Route 495 divides the drainage area at about midpoint.

5.2 Design Data

No hydrologic computations or hydraulic data has been recovered for the dam.

5.3 Experience Data

No records are available in regard to past operation of the reservoir,nor of surcharge encroachments and flows through the spillway. The maximum past outflows are unknown.

5.4 Test Flood Analysis

Hydrologic characteristics of Ames Pond Dam and drainage area were evaluated in accordance with criteria given in Recommended Guidelines for Safety Inspection of Dams. As indicated in Section 1.2, paragraphs c and d, Ames Pond Dam is classified as small in size and has a high hazard potential. The recommended Test Flood for hydraulic evaluation of such a dam ranges from a ½ probable maximum flood to a full PMF. A ½ PMF was considered to be appropriate for the test flood in this case.

Precipitation data was obtained from Hydrometeorolgical Report NO. 51, which for this area of Massachusetts is about 24.8 in. of 6 hour maximum rainfall over a 10 square mile area. This value was then reduced by 20 percent to allow for basin size, shape and fit factors and further reduced by 0.4 in. for infiltration losses. The six hour rainfall was distributed into one hour incremental periods as suggested in COE Publication EC 1110-2-1411.

A triangular incremental unitgraph was assumed for the inflow hydrograph using a computed lag time of 5.68 hours to derive a time-to-peak for the triangular hydrograph of 5.07 hours (see computations on Sheets D-7 and D-10, Appendix D), indicating a peak inflow of about 1,230 cfs or a CSM of about 778 cfs.

Discharge tables and curves for the spillway, the saddle in the right abutment and for the top of dam and dikes are shown on sheets D-4 thru D-6, Appendix D. For determining surface areas and surcharge capacities planimetered areas were taken from contours delineated on 1:24,000 and 1:25,000 U.S.G.S. sheets.

A flood routing was performed for the test flood. Results of this routing is shown on sheets D-11 thru D-13, Appendix D and summarized as follows:

Flood Magnitude	Test Flood Inflow (cfs)	Maximum Res. El. (ft. NGVD)	Max. Head Over Low Point on Rt. Abutment	Routed Test Flood Outflow (cfs)
½ PMF	1,230	151.2	1.7 ft.	790

From the above table, it can be seen that the project will not pass the routed test flood outflow without overtopping the crest of the saddle in the right abutment by 1.7 ft. At that time the crests of the dam embankment and Dike A embankment would be overtopped by 0.5 ft. The facility can handle about 8 percent of the routed test flood outflow without overtopping the saddle in the right abutment.

5.5 Dam Failure Analysis

A breach from overtopping or due to structural failure of either the main dam or dikes is a possibility. For this analysis a breach of the Dam and Dike A were considered separately as the breach outflows from the structures would initially follow different water courses. The New England Division, Corps of Enginers "Rule of Thumb" Guidance for Estimating Downstream Dam Failure Hydrographs was used as a guide in computing the breach outflows.

In the event of a breach of Dike B it is estimated that the breach discharge would be about 25 percent of that of Dike A and the breach flows would go into the same damage reach as that of Dike A

Dam Failure. A breach width of 40 percent of the dam length at midheight equal to 46 ft. and a failure height of 8.5 ft. was assumed for this analysis which results in a breach outflow of about 1,975 CFS including about 60 CFS from the spillway, (see sheets D-14 thru D-22, Appendix D).

Discharges from the breach will flow down a small meandering stream called Meadow Brook to the Shawsheen River about 3.2 miles downstream of the dam. Kendall St. a local roadway crosses Meadow Brook about 500 ft. downstream of the dam. There is no significant storage between the dam and Kendall St. and it is estimated the breach flow of 1,975 CFS will overtop Kendall St. by about 3 ft. and three houses adjacent to the street will be flooded to depths of 2 ft. to 3 ft.

Beyond Kendall St. an approximately 5,600 ft. long reach extends to Pinnacle St. and contains a relatively large swamp which will have a significant effect on retarding the breach flow. It is estimated the breach flow will be about 1,200 CFS on the downstream side of the swamp. Pinnacle Rd. will be overtopped by 2.5 ft., one house will be flooded by about 2 ft. and a commercial garage to a depth of about 1 ft. The next area of significant flooding will be at East St. where it is estimated the street will be overtopped but no other structures will be flooded. Further downstream near the confluence of Meadow Brook and the Shawsheen River the flood flows will be reduced to about 700 CFS and Shawsheen St. will be slightly overtopped, but no other significant flooding will take place. It is estimated that no flooding along the reach will occur due to the prefailure spillway discharge.

Dike A Failure. For this failure anlaysis a breach width of 20 percent of the dike's length at mid-height was used equal to 32 ft. The height of the breach was assumed from the toe of the dike to the top of the embankment a distance of about 11.2 ft. Using these dimensions an outflow of about 2,000 cfs would be realized. (See sheets D-23 thru D-24 Appendix D).

Discharges from the breach will flow down a natural swale in a recently developed residential area, crossing Cardigan Road, Dike Court, and Kendall St., and then returning to Meadow Brook. There will be no significant storage in the reach and it is estimated four houses in the vicinity of Cardigan Road and Dike Court will be flooded to depths of 2 ft. to 3 ft. and four houses in the vicinity of Kendall St. will be flooded by about 3.5 ft. of water.

In summary, in the areas described above there is considerable residential development and several houses would be flooded by a breach of either the Dam or Dike A at Ames Pond. Several local roadways would be flooded and it is estimated the economic loss would be excessive. There also is the potential for the loss of more than a few lives. Sheet D-25, Appendix D shows the area of potential flooding. In accordance with the Recommended Guidelines for Safety Inspection of Dams the dam has been classified as having a high hazard potential.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

The Ames Pond Dam and Dikes are in poor condition at the present time as revealed by the field inspection of October 20,1980. There are several items of a remedial nature which were observed during the field visit and which will require treatment as outlined in Section 7. There are also deficiencies of a potentially more serious nature which require the services of a professional engineer as also outlined in Section 7.

6.2 Design and Construction Data

No definitive plans of the embankments, spillway, and northeast dikes are available. Data on construction of the embankments including detailed laboratory soil test results are also not available. Calculations pertaining to the stability of the embankment, spillway, and the left concrete parapet wall are unavailable.

6.3 Post-Construction Changes

There are no records of any post-construction changes made to the dam or spillway over the course of its history.

6.4 Seismic Stability

The dam is in Seismic Zone NO. 3. Phase I Guidelines recommend, as a minimum, that suitable analysis made by conventional equivalent static load methods should be on record for dams in Zone No. 3. As far as can be determined, no such analysis has been made.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. On the basis of the Phase I visual examination, Ames Pond Dam is judged to be in poor physical condition. The spillway facility will only pass about 8 percent of the routed test flood outflow. There is no operational low level outlet at the facility. These factors in addition to other deficiencies reveal that a further investigation should be carried out and that some remedial work is needed.

b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgement.

c. Urgency. The recommendations and remedial measures enumerated below should be implemented by the owner within one year after receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the owner, Beacon Mortgage, Inc., should retain the services of a registered professional engineer experienced in the design of dams to make further investigations of the following, and should implement the results:

(1) Perform a detailed hydrologic and hydraulic analysis to further assess the need for and means to increase the project discharge capacity.

(2) Determine the feasibility of raising the embankment and the low section of the reservoir rim near the right abutment.

(3) Investigate the seepage through the spillway's downstream training walls.

(4) Recommend methods of repair of the spillway.

(5) Investigate the wet area at the downstream toe of Dike A.

(6) Investigate the need for bedding and rip rap on the upstream slopes of the dam and dike embankments.

(7) Investigate the tilting of the concrete wall on the dam's left embankment.

(8) Investigate the feasibility of reconditioning the low level outlet or providing another means for draining the pond in the event of an emergency.

(9) Make a seismic investigation and analysis of the dam by conventional equivalent static load methods.

(10) Remove all large trees (greater than 4 in. dia.) including root systems from the crest, slopes and within 10 ft. of the toe of the dam and dikes and backfill with a suitable compacted material.

7.3 Remedial Measures

a. Operation and Maintenance Measures

(1) Repair erosion of the dam's slopes at the intersection of the embankments with the concrete spillway structure.

(2) Institute an annual technical inspection program for the dam and appurtenent structures.

(3) Develop an "Emergency Action Plan" that will include an effective preplanned downstream warning system, locations of emergency equipment, materials and manpower, authorities to contact and potential areas that require evacuation. The plan will also include round-the-clock monitoring of the project during periods of heavy precipitation.

(4) Implement a regular periodic maintenance program.

(5) Remove small trees (less than 4 in. dia.) and brush growth from all embankments.

7.4 Alternatives

There are no feasible alternatives to the above recommendations.

Appendix A

Inspection Checklist

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Ames Pond Dam DATE October 20, 1980

OWNER Beacon Mortgage, Inc. TIME 1:00 PM

WEATHER Sunny - 60° F

W.S. ELEV. 147.8 U.S. ____ DN.S.

INSPECTION PARTY

A/E REPRESENTATIVES	OWNER'S REPRESENTATIVES
1. Pasquale E. Corsetti	1.
2. Roger F. Berry	2.
3. Carl J. Hoffman	3.
4. William S. Zoino	4.
5.	5.

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Hydraulics	Roger F. Berry	LBA
2.	Hydrology & Structures	Carl J. Hoffman	LBA
3.	Geotechnical	William S. Zoino	GZA
4.	General Features	Pasquale E. Corsetti	LBA
5.			
6.			
7.			
8.			
9.			
10.			

LBA - Louis Berger & Associates, Inc.
GZA - Goldberg-Zoino & Associates, Inc.

PERIODIC INSPECTION CHECKLIST

OJECT Ames Pond Dam DATE 20 Oct. 1980

OJECT FEATURE Dam Embankment NAME W. S. Zoino

SCIPLINE Geotechnical NAME

AREA EVALUATED	CONDITIONS
KE EMBANKMENT	
Crest Elevation	150.7
Current Pool Elevation	147.8
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Poor, irregular
Horizontal Alignment	Poor-Concrete curb wall on left embankment tilting downstream
Condition at Abutment and at Concrete Structures	Poor
Indications of Movement of Structural Items on Slopes	Concrete curb wall on left embankment tilted 30° to vertical.
Trespassing on Slopes	Severe
Vegetation on Slopes	Moderate on both up + downstream slopes
Sloughing or Erosion of Slopes or Abutments	Trespassing, Paths
Rock Slop Protection - Riprap Failures	Poor, Large Boulders No Bedding
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Minor 1-2 gpm through spillway training wall
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECKLIST

)JECT Ames Pond Dam DATE 10/20/80

)JECT FEATURE Dike A Embankment NAME W. S. Zoino

5CIPLINE Geotechnical NAME

AREA EVALUATED	CONDITIONS
KE EMBANKMENT	
Crest Elevation	150.7
Current Pool Elevation	147.8
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A-Root growth on crest
Movement or Settlement of Crest	None
Lateral Movement	None
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	Minor
Vegetation on Slopes	Heavy upstream and downstream
Sloughing or Erosion of Slopes or Abutments	Minor
Rock Slop Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	Minor Seepage 1-2 gpm
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECKLIST

OJECT Ames Pond Dam DATE 12/5/80

OJECT FEATURE Dike B Embankment NAME W. S. Zoino

SCIPLINE General Features NAME

AREA EVALUATED	CONDITIONS
KE EMBANKMENT	
Crest Elevation	153.5
Current Pool Elevation	148.0
Maximum Impoundment to Date	Unknown
Surface Cracks	None
Pavement Condition	N/A
Movement or Settlement of Crest	Depression about 1.5 ft. deep and 6 ft. wide near left abut.
Lateral Movement	None-slopes constructed irregular
Vertical Alignment	Fair-not uniform
Horizontal Alignment	Fair-slopes irregular
Condition at Abutment and at Concrete Structures	Depression at left abutment.
Indications of Movement of Structural Items on Slopes	Remanents of conc.wall U/S slope-see below
Trespassing on Slopes	Minor
Vegetation on Slopes	Heavy upstream and downstream slopes
Sloughing or Erosion of Slopes or Abutments	None
Rock Slop Protection - Riprap Failures	None
Unusual Movement or Cracking at or near Toes	None
Unusual Embankment or Downstream Seepage	None
Piping or Boils	None
Foundation Drainage Features	None
Toe Drains	None
Instrumentation System	None

Dike appears to be of recent construction replacing approx. 2 ft. high concrete wall. Dike material probably placed around existing trees which now appear on slopes of dike.

DAM NO._____

ks & Recommendations: (Fully Explain)

all Condition:

1. Safe_____.
2. Minor repairs needed_____.
3. Conditionally safe - major repairs needed__X__.
4. Unsafe_____.
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list_____.

rream Face of Dam: Condition: 1. Good_____. 2. Minor Repairs__X__.
3. Major Repairs____. 4. Urgent Repairs_____.

Comments: Trees & Brush

---

ency Spillway: Condition: 1. Good_____. 2. Minor Repairs_____.
3. Major Repairs____. 4. Urgent Repairs_____.

Comments:

---

level @ time of inspection: 6" ft. above__X__. below_____.
top of dam_____. principal spillway__X__.
other_____.

---

ary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment__X__.

Animal Burrows and Washouts_____.

Damage to slopes or top of dam_____.

Cracked or Damaged Masonry__X__.

Evidence of Seepage_____.

Evidence of Piping_____.

Erosion_____.

Leaks_____.

Trash and/or debis impeding flow_____.

Clogged or blocked spillway_____.

Other_____.

INSPECTION REPORT - DAMS AND RESERVOIRS

tion: City/Town TEWKSBURY. Dam No. 4-9-295-1

of Dam AMES POND. Inspected by: PACILLO-IAQUILLO

Date of Inspection 1-12-79

r/s: per: Assessors_____. Prev. Inspection_____.

Reg. of Deeds_____. Pers. Contact_____.

Name	St. & no.	City/Town	State	Tel. no.
BEACON MORTGAGE CO				
1425 BEACON ST.		BROOKLINE		232-7850

etaker (if any) e.g. superintendant, plant manager, appointed by absentee owner, pointed by multi owners.

Name	St. & no.	City/Town	State	Tel. no.

. of Pictures taken 0.

gree of Hazard: (if dam should fail completely)*

1. Minor_____. 2. Moderate X.

2. Severe_____. 4. Disastrous_____.

This rating may change as land use changes (future development)

tlet Control: Automatic X. Manual_____.

Operative_____yes ;_____No.

Comments: 12" I.P. Siphon

CRACKS in Spillway walls -

stream Face of Dam: Condition:

1. Good_____. 2. Minor Repairs X.

3. Major Repairs_____. 4. Urgent Repairs_____.

Comments: TREES and BRUSH

The Commonwealth of Massachusetts

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGR.
DIVISION OF WATERWAYS

100 Nashua Street, Boston 02114

To: Joseph Iagello/ Dam Section

From: B. H. Harrington/ License and Permits Section

Re: Lake Ames, Tewksbury; Middlesex County
sheet 30a and 30c.

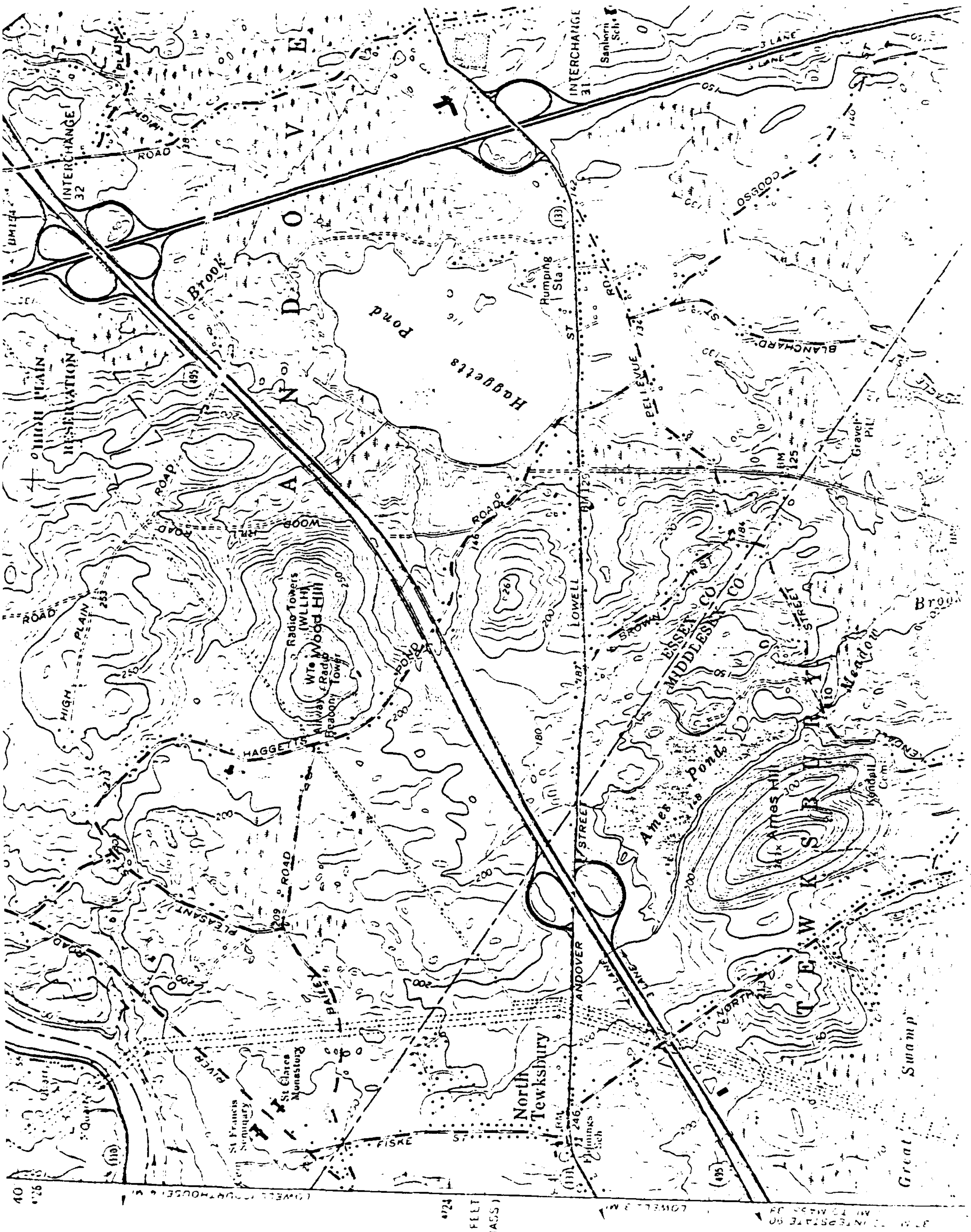
A review of existing records in this office, appears to indicate conclusively, that the present impounded volume of the existing ponded area can be considered as original artificial flowage from Strongwater Brook (Meadow Brook so-called). Said brook rises just northeast of North Tewksbury, about 2½ miles east of Lowell, at approximate altitude 180 feet above sea level and flows southeastward about 2 miles southeast of Tewksbury Center.

Additional knowledge of the original pond status could be determined by research through old deeds, specifically to the flooding of the abutting lands to the waterway, which could possibly be still privately held, although the parties using water therefrom, could have flowage rights for their purposes.

Lake Ames (so-called), elevation is about 148.00 ft. above M.S.L. on the North American datum of 1927. It also appears, to have some kind of control structure present and which possibly could be evaluated under c. 253 s.44 as amended by c. 706 of 1975; however, this is a determination that would be made by the appropriate officiary.

Respectfully submitted,
Bernard Harrington
Bernard H. Harrington
Assistant Civil Engineer

Anno Domini
November 7, 1978



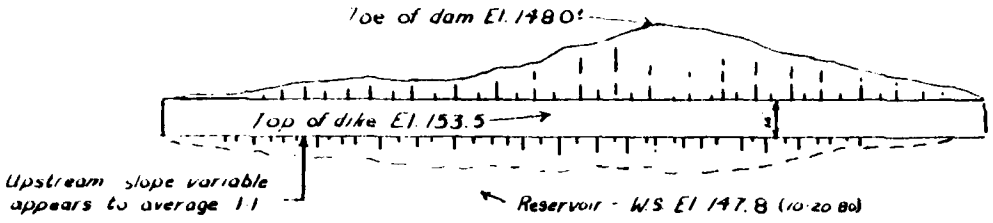
INTERCHANGE 31
INTERCHANGE 32
Sanborn Sch
OSGOOD
BLANCHARD
Pumping Sta
Haggetts Pond
Brook
BELLEVUE
HIGH PLAIN RESERVATION
WOOD HILL ROAD
Radio Towers (WLLH)
Wood Hill
Airway Radio Beacon Tower
HAGGETTS POND ROAD
LOWELL
ESSEX CO
MIDDLESEX CO
BROWN ST
Gravel Pit
Meadow
Ames Pond
Ames Hill
Kendall Cem
PLEASANT
ROAD
BAILEY
ANDOVER STREET
NORTH ST
St Clares Monastery
St Francis Seminary
North Tewksbury
FISKE ST
Great Swamp
630 000 FEET (MASS)

INVENTORY OF DAMS

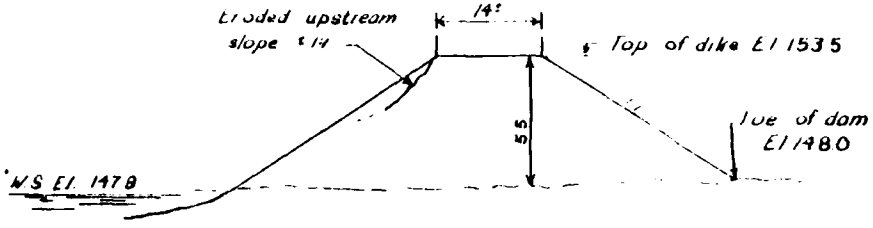
DISTRICT NO. 4 PREPARED BY M. Pacilio DATE 1-16-79

(1) CITY - TOWN	(2) NAME OF DAM	(3) TOPO SHEET	(4) OWNER OF DAM NAME & ADDRESS	(5) CARETAKER OF DAM NAME & ADDRESS	(6) CODE DESIGNATION
TEWKSBURY	AMES POND	30 A	BEACON MORTGAGE CO. 1425 BEACON ST. BROOKLINE, MA 02146		4-9-295-1

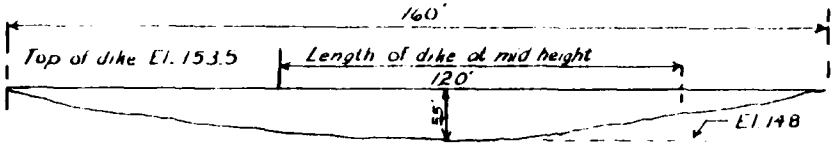
B-4



PLAN

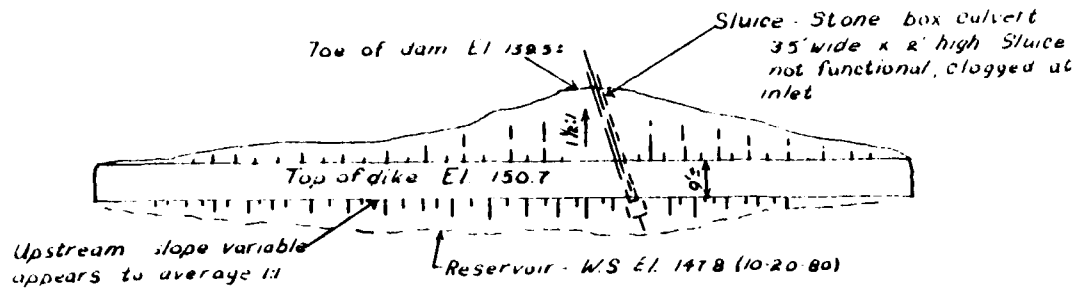


SECTION THRU DIKE

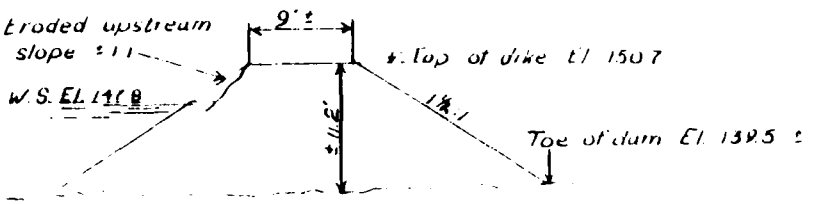


PROFILE ALONG AXIS OF DIKE

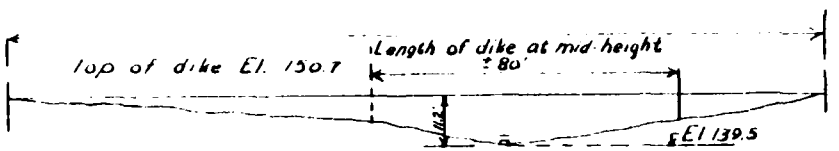
AMES POND DAM
DIKE B



PLAN

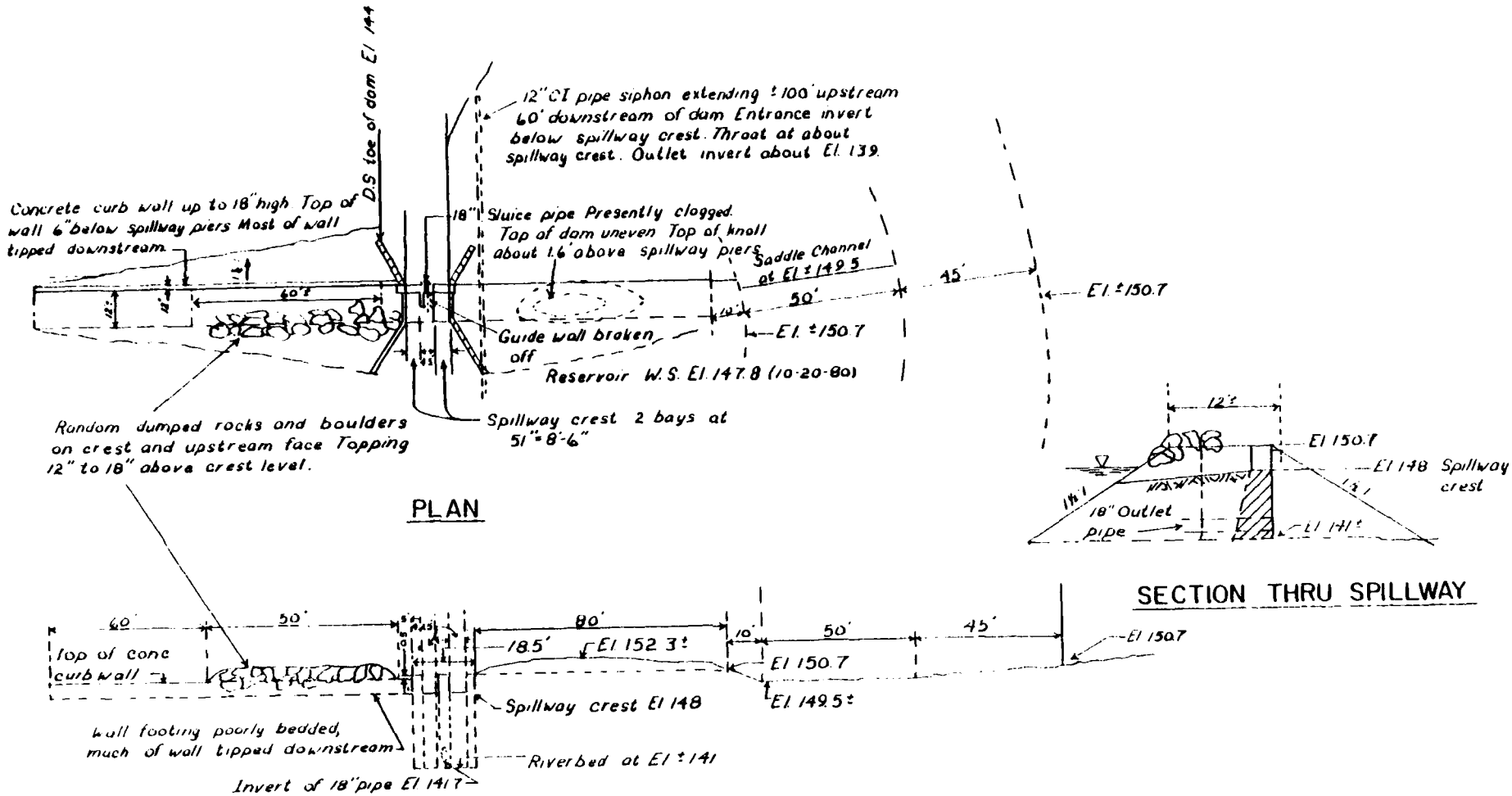


SECTION THRU DIKE



PROFILE ALONG AXIS OF DIKE

AMES POND DAM
DIKE A



AMES POND DAM

B-1

Appendix B

Engineering Data

PERIODIC INSPECTION CHECKLIST

PROJECT Ames Pond Dam DATE 20 October 1980

PROJECT FEATURE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITIONS
Outlet Works - Control Tower	N/A
Outlet Works - Outlet Structure and Outlet Channel	N/A
Outlet Works - Service Bridge	N/A

PERIODIC INSPECTION CHECKLIST

PROJECT Ames Pond Dam DATE 20 October 1980

PROJECT FEATURE Spillway NAME

DISCIPLINE Hydraulics/Structures NAME Carl Hoffman

AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	poor
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	yes
Floor of Approach Channel	silted
b. Weir and Training Walls	
General Condition of Concrete	poor
Rust or Staining	minor
Spalling	yes
Any Visible Reinforcing	none
Any Seepage or Efflorescence	none
Drain Holes	none
c. Discharge Channel	
General Condition	poor
Loose Rock Overhanging Channel	none
Trees Overhanging Channel	yes
Floor of Channel	dumped random stone riprap
Other Obstructions	debris - trees etc.

D/S training walls cracked and seeping

PERIODIC INSPECTION CHECKLIST

PROJECT Ames Pond Dam DATE 20 October 1980

PROJECT FEATURE Low Level Outlet NAME

DISCIPLINE Hydraulics/Structures NAME Carl Hoffman

AREA EVALUATED	CONDITIONS

OUTLET WORKS - TRANSITION AND CONDUIT

General Condition of Concrete - N/A metal pipe

Rust or Staining on Concrete - yes

Spalling - N/A

Erosion or Cavitation - N/A

Cracking - N/A

Alignment of Monoliths - N/A

Alignment of Joints - Not visible

Numbering of Monoliths - N/A

Some seepage through pipe about 0.5 gpm

PERIODIC INSPECTION CHECKLIST

PROJECT Ames Pond Dam DATE 20 October 1980

PROJECT FEATURE Low Level Outlet NAME

DISCIPLINE Hydraulics/Structure NAME Carl Hoffman

AREA EVALUATED	CONDITIONS

OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE

a. Approach Channel

Slope Conditions - unknown

Bottom Conditions - appears silted

Rock Slides or Falls - none

Log Boom - none

Debris - minor, leaves

Condition of Concrete Lining - poor, cracks, conc. separated and broken away.

Drains or Weep Holes - none evident

b. Intake Structure

Condition of Concrete - poor

Stop Logs and Slots - N/A - training wall broken

Merrimack Engineering Services Inc.
66 Main Street Suite 13
ANDOVER, MASSACHUSETTS 018°0

(617) 475-3555

LETTER OF TRANSMITTAL

DATE 1/8/79 | JOB NO

ATTENTION Joe Iagallo

RE Ames Pond Dam

TO Joe Iagallo
WATERWAYS BRANCH
DEPT of PUBLIC WORKS
100 NASHUA ST.
BOSTON MASS.

DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATERWAYS
RECEIVED
Referred To
Report back to
File

GENTLEMEN:

WE ARE SENDING YOU ☐ Attached ☐ Under separate cover via _____ the following items:

☐ Shop drawings ☐ Prints ☒ Plans ☐ Samples ☐ Specifications
☐ Copy of letter ☐ Change order ☐ COMPLETED APPLICATION

COPIES	DATE	NO.	DESCRIPTION
1			AUTHORIZATION REQUEST TO ALTER or CONSTRUCT a Dam
2			COPIES OF PROPOSED ALTERATION

THESE ARE TRANSMITTED as checked below:

☐ For approval ☐ Approved as submitted ☐ Resubmit _____ copies for approval
☒ For your use ☐ Approved as noted ☐ Submit _____ copies for distribution
☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints
☐ For review and comment ☐ _____
☐ FOR BIDS DUE _____ 19____ ☐ PRINTS RETURNED AFTER LOAN TO US

REMARKS THIS COMPLETED FORM IS TO REPLACE THE ONE SENT TO YOUR OFFICE AROUND 12/21/78. IF YOU HAVE ANY QUESTIONS ON THE APPLICATION PLEASE FEEL FREE TO CONTACT ME AT ANY TIME.

NOTE ALSO THAT I SENT YOU EARLIER A STUDY OF THE DRAINAGE AREA OF AMES POND AND A SURVEY OF THE CONDITION OF THE DAM.

COPY TO _____

B-10

SIGNED: F E Gilgan

If enclosures are not as noted, kindly notify us at once

FORM 240-2 - Available from [illegible] Townsend Mass 01469

MERRIMACK ENGINEERING SERVICES
PROFESSIONAL ENGINEERS
LAND SURVEYORS

66 MAIN STREET - SUITE 13
ANDOVER, MASSACHUSETTS 01810
TEL. (617) 475-3555, 375-5721

Principal
FRANCIS E. GRIGGS, Jr., P.E., R.L.S. Tel. 688-3885
Associate
STEPHEN E. STAPINSKI Tel. 374-9950

December 19, 1978 (Sent 1/9/79 as A Duplicate)

Mr. Joseph Iagallo
Water Ways Branch
Dept. of Public Works
100 Nashua Street
Boston, Massachusetts

Dear Mr. Iagallo:

Attached you will find a completed application requesting authorization to construct or alter a reservoir, reservoir dam, or a mill dam. The subject dam is located on Ames Pond in Tewksbury, Massachusetts.

You will note that our run-off calculations are based upon the rational method and a 50 year storm. The method recommended in the "Design of Small Dams" is for larger watersheds. Please advise if this method is acceptable.

Very truly yours,
MERRIMACK ENGINEERING SERVICES

Francis E. Griggs, Jr., P.E., R.L.S.

The Commonwealth of Massachusetts

Executive Office of Transportation and Construction

Department of Public Works

100 Nashua Street, Boston 02114

APPLICATION FOR AUTHORIZATION TO CONSTRUCT OR ALTER A RESERVOIR, RESERVOIR DAM OR MILL DAM

JURISDICTION - Chapter 253 of the General Laws as amended by Chapter 595 of the Acts of 1970

CONDITIONS OF D.P.W. JURISDICTION

Shall not apply to small dams, constructed for irrigation or for other purposes, the breaking of which would involve no risk to life or property, nor to standpipes or tanks, nor to a dam where the area draining into the pond formed thereby does not exceed one square mile; unless the dam is more than ten feet in height above the natural bed of the stream at any point, or unless the quantity of water which the dam impounds exceeds one million gallons.

Revised 10-J

Part "A"

JURISDICTIONAL DETERMINATION
(check the appropriate column)

	Yes	No
1. Is there a risk to Life and Property downstream in the event of failure?	✓	
2. Does the area draining into the pond exceed one square mile?	✓	
3. Does the height of the dam exceed 10 ft. above the natural bed of the stream at any point?		✓
4. Does the volume of water impounded at maximum pool level exceed one million gallons?	✓	

If the answer to any one of the above questions is Yes, then the Commissioner of Public Works has jurisdiction. Proceed with Part B of this application.

If the answers to all four of the above questions are no, please submit backup information for a review by this Department for our jurisdictional determination. The backup information should include at least:

a. A copy of a topographic map clearly indicating the location of the dam and the effective drainage area.

b. A sketch showing the maximum section of the dam indicating its height, as measured from the lowest point of the streambed.

c. Calculations for the volume of water impounded at the maximum design pool level.

d. A brief statement pertaining to downstream conditions with respect to risk to life and property.

e. The signature of applicant and engineer.

Part "B"

GENERAL INFORMATION

1. Location (City-Town) Tewksbury Mass

2. Detailed description of dam location

Located at the southerly end of Ames Pond

3. Present or Prospective Owner(s)

Name(s) Beacon Mortgage Co
Street 1425 Beacon St
City/Town Brookline State Mass Zip 02146
Telephone 232-7850

4. Name of U.S. Geological Survey Map Quadrangle

Lawrence

5. Name of Reservoir or Waterway Ames Pond

6. Is there specific legislative authority to construct the dam

Yes ( ) Identify _____
No (X)

7. Purpose for the dam Originally to dam a Pond for sport fishing

8. Nature of the work

Proposed dam ( )
Alteration of existing dam (X)
Major repair of existing dam ( )

Part "B" (continued)

HAZARD EVALUATION

(Downstream field investigation)

1. The estimated number of people that could be affected by overtopping or failure of the structure, and to what degree they would be affected.

Difficult to estimate. At least the two homes adjacent to the culvert crossing on Kendall road will be affected. Other homes on the "Great Swamp" may receive some water damage (minor). Number of people ≈ 10

2. The number of properties (homes, buildings etc.) and the estimated extent of damage by overtopping or failure.

Two on Kendall road. Possibly some wet basements on Leighton road, Pinnacle road and Kendall road.

3. Roads (type) or other structures that could be affected by overtopping or failure Kendall Road (Town Street), a new box culvert is being constructed at the location greatly increasing the flow capacity

4. Additional Information:

Part "B" (continued)

HYDROLOGIC CONSIDERATIONS

Procedures for hydrologic design as contained in the latest edition of the U. S. Department of the Interior, Bureau of Reclamation "Design of Small Dams" Due to the size of the watershed the rational method with a 50 year storm was utilized.

1. Peak Cutflow 1606 c.f.s.
2. Design storm duration 1 hour.
3. Rainfall Intensity 4.8 "/hr.
   Percent Runoff 36 % 1.72 inches.
4. Contributory Drainage Area 1.5 sq.mi.
   (attach a copy of U. S. Topographic Map with the outline of the drainage divide).
5. Previous Known flood of record No record available
   (month) _____ (year) _____
6. Design maximum flood level elevation 149.7.
7. Additional information:

Part "B" (continued)

DESIGN CRITERIA

1. Datum used:
   (a) M.S.L. of 1929 ✓.
   (b) Assumed _____.
   (c) Other _____.

2. Maximum height of the dam 9.4 ft.
   (a) Top elevation of dam 157.7.
   (b) Top elevation of spillway 147.01.

3. Volume of water impounded, at maximum design pool level. 150,000,000 gallons Assuming Average depth of 5

4. Present river bed or channel elevation @ dam 146.67 (August, 75).

5. Normal pool elev. 147.0.
   surface area 96 ac.

6. Maximum pool elev. 149.7 with flash boards.
   surface area 92 ac.

7. Type of structure (earth, concrete, etc)
   Earthen Dam, Concrete spillway.

8. Crest width E.C ft.

9. Freeboard, as measured from the maximum design pool level Zero.

10. Length of Principal spillway 15.

11. Description of principal spillway See attached Plans.

12. Emergency spillway Yes ( ) No (X)
    If yes, describe _____.

13. Gates Yes ( ) No (X) Number _____. Size _____.

14. Nature of slope protection (riprap, vegetated etc.) Grassed some riprap.

15. Stop log structure(s)
    Yes ( ) No (X) Mechanical ( ) Manual ( )

Part "B" (continued)

SUBSURFACE INVESTIGATION

Boring logs, analysis and recommendations to accompany this application. No Borings Taken

CONSTRUCTION DRAWINGS

(Submit 2 copies with this application) Names & addresses of property owners for all parcels of land within the flowage area must be clearly indicated on the plan.

CONSTRUCTION SPECIFICATIONS

(Submit 2 copies with this application) Specs will be indicated on plan drawings.

CERTIFICATION OF INSPECTION DURING CONSTRUCTION

Inspecting agent (Must be approved by the Design Engineer)

Name _____

Street _____

City/Town _____ State _____ Zip _____

Telephone _____

Inspection during construction periods will be conducted by the approved engineer on a full-time basis. Bi-monthly progress reports are to be submitted to the Massachusetts Department of Public Works (local District office) with copies submitted to the owner and design engineer.

Inspector signature _____ Date _____

Applicant signature _____ Date _____

Design engineer _____ Date _____

Part "B" (continued)

SIGNATURE SHEET

APPLICANT

Name [illegible] Mortgage Company

Street 1475 Beacon Street

City/Town Brookline State Mass Zip 02146

Telephone 232-7850

Signature Harry McCracken By [signature] Date 12/19/1

CONSULTANT ENGINEER FIRM

Name Merrimack Engineering Services Inc

Street 66 Main Street - Suite 13

City/Town Andover State Mass Zip 01810

Telephone 475 3555

*Signature and P.E. Stamp [signature] Date 12/19

COMMONWEALTH OF MASSACHUSETTS FRANCIS E. GRIGGS No. 22112 REGISTERED

*(P.E. STAMP & SIGNATURE REQUIRED ON ALL SUBMITTALS)

Final or "as built" drawings are to be submitted to this office upon completio: of the project.

No alterations shall be made without the prior review and approval of the Commissioner.

FAILURE TO COMPLY WITH THE TERMS OF THIS APPLICATION WILL AUTOMATICALLY CAUSE REVOCATION OF THE COMMISSIONER'S APPROVAL.

DRAINAGE SURVEY
DAM SURVEY

SUBMITTED TO THE TOWN OF

TEWKSBURY

CONSERVATION COMMISSION

NOV 1, 1978

MERRIMACK ENGINEERING SERVICES, Inc.
66 Main Street, Suite 13
Andover, Massachusetts 01810
planners ● engineers ● surveyors

MERRIMACK ENGINEERING SERVICES
PROFESSIONAL ENGINEERS
LAND SURVEYORS

66 MAIN STREET - SUITE 13
ANDOVER, MASSACHUSETTS 01810
TEL. (617) 475-3555, 375-5721

Principal
FRANCIS E. GRIGGS, Jr., P.E., R.L.S. Tel. 688-3885
Associate
STEPHEN E. STAPINSKI Tel. 374-9950

DRAINAGE STUDY FOR AMES POND

Ames Pond is a man made pond located in North Tewksbury near the Andover Town Line and just south of Interstate 495. The pond was built originally as a part of the Ames Estate and was used for sport fishing.

The watershed for the pond consists of approximately 340 acres of land in Andover and approximately 600 acres in Tewksbury for a total watershed of 940 acres. The entire watershed is drained by two main streams which flow from north to south. One stream has its headwaters just north of the intersection of Fiske Road and Maplewood Street in Tewksbury. The other stream has its headwaters near the power lines in Andover.

The Andover portion of the watershed is primarily undeveloped with only approximately 40 single family dwellings in existence. Of these 5 are on Bailey Road, 8 on Lowell Street, 4 on Brown Street and the remainder on Rugthers Road and Sheffield Circle. There are plans for a small cul-de-sal off Bailey Road, and a development off of Brown Street. Approximately 1800 feet of I-495 is in the Ames Pond Watershed in Andover.

The Tewksbury portion of the watershed is more developed with the North Tewksbury area, Deering Drive, Maplewood Road, Woodcrest Road, Fiske Street, Andover Street, North Street and Catamount Road and to a lesser degree Overlook Road. There are 15 homes on North Street, 13 on Andover Street, 19 on Fiske Road, 11 on Woodcrest, 14 on Maplewood, 27 on Deering Drive and 5 on Catamount Road. In addition, I-495 has 3600 LF in the watershed plus two ramps, the digital complex with its buildings, roadways and parking lots is also located within the watershed.

CURRENT GROUND CONDITIONS IN AMES POND WATERSHED

Andover Portion

Assume all Houses 30 x 60
with 15' x 40' Driveways
Impervious Area = 30 x 60 x 40
+ 15 x 40 x 40 = 96,000SF = 2.2 Acres

Roads and Streets

	4200' x 30'	= 126,000SF = 2.9 Acres
I-495	1800 x(45+45)	= 162,000SF = 3.7 Acres

Total Impervious 8.8 Acres
Total Wooded 331.2 Acres

Tewksbury Portion

Impervious Area = 30 x 60 x 104
15 x 40 x 104 = 249,600SF = 5.7 Acres
Roads and Streets 18,700LF x 30' = 561,000SF = 12.9 Acres
I-495 Main Road 3600 x(45+45) = 324,000SF = 7.4 Acres
Ramps 7200 x(15) = 108,000SF = 2.5 Acres
Digital (Bldgs.,Parking and Roadway) = 660,000SF = 15.10 Acres
Ames Pond = 3,920,000SF = 90.00 Acres±

Total Man Made Impervious = 43.7 Acres
Total Pond Area = 90.0 Acres
Total Wooded, etc. = 470.0 Acres

Weighted "C" Calculation

Total Watershed Area = 940 Acres
Total Impervious (incl. Pond) = 142.5 Acres
Total Wooded, etc. = 797.5 Acres

C Woods assumed = .25(on high side)[For slightly pervious soils with turf slopes 2% or less)
C Impervious assumed = .95(on high side)

$$C_{wt} = \frac{(797.5)\ .25 + 142.5(.95)}{940}$$

$$C_{wt} = .356$$

Time of Concentration Calculation

- Maximum Length of Overland And Stream Flow = 6000LF
- Drop in Elevation 250.-148 = 102ft.

T_c = 30min. x 2 = 60min. = 1hr.
Page 144 .A153
Handbook of Steel Drainage and Highway Construction Products

Rainfall Calculation

10 Year Storm = 2.52/3.3"/hr.
25 Year Storm = 2.92/4.2"/hr.
50 Year Storm = 3.22/4.8"/hr.

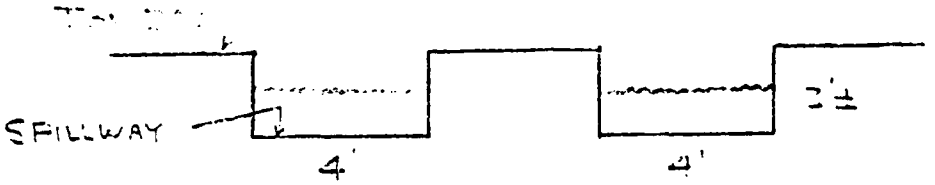
Runoff Calculations

Rational Method

$Q = C\ i\ A$
$Q_{10} = .356\ (3.3)\ 940 = 1104CFS$

$Q_{25} = .356\ (4.2)\ 940 = 1406CFS$
$Q_{50} = .356\ (4.8)\ 940 = 1606CFS$

Considering a 50-year storm discharging 1606CFS into the 90 acre pond for a one hour duration would result in a water level rise of 1.5' if no water escaped over the spillway.
The discharge capacity of the spillway can be approximated as follows:



Assumed Sharp Crested Weir H = avg. Say 1.5'

A = 8(1.1) = 8.8SF

L = 8ft.

d = 1.1

$Q = 3.33(8.0 - .2(1.5))(1.5)^{3/2}$ = 47CFS (velocity of approach small - suppressed weir)

$Q = 3.33\ LH\ 3/2\ (1 + .26\ \frac{LH^2}{A})$

Q = 3.33 8(1.5) 3/2 (1 + .26)

Q = 66CFS

After Development of Ames Hill Estates 3

Additional Impervious Area in:

Tewksbury (Assume Drives 70' long - 10'wide)
Houses - 66 x 30 x 60
66 x 10 x 70 = 165,000SF = 3.8 Acres
Roadway and Sidewalk
5000 x 36 = 180,000 = 4.1 Acres

Total Tewksbury Impervious Area = 141.6
Total Tewksbury Wooded Area = 458.4 Acres

Total Watershed

Impervious = 150.4
Wooded = 789.6

$C_{wt.} = \frac{150.4(.95) + 789.6\ (.251)}{940} = .362$

Difference = .362 - .356 = .006

DATE [illegible] **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. [illegible] OF [illegible]

BY ______ DATE ________ PROJECT [illegible]

CT [illegible]

[illegible]

READ #2 [illegible] READ # [illegible]
#1 [illegible]7 # [illegible] A [illegible]
10 [illegible]

AREA = 10 [illegible] x 0.1433 = 155 SQ MI

FIND RESE[illegible] AREA ELEV 145

READ #2 45.[illegible] READ #[illegible] AVE [illegible]
#1 44.24 #[illegible]
0.8[illegible]

AREA = 0.[illegible] x 91.[illegible] = 81 A[illegible]

FIND AREA @ ELEV 150

READ #2 4[illegible] READ #3 47.13
#1 44.[illegible] #2 46.[illegible]
1.13 1.[illegible]

AREA = 1.13 x 91.33 = 10[illegible] A[illegible]

FIND AREA @ ELEV 160

READ #2 5[illegible] READ #3 54.[illegible]
#1 5[illegible] #2 52.93
2.[illegible] 1.[illegible]

READ #4 56.[illegible] AVE = 1.[illegible]
#3 54.65
1.[illegible]

AREA [illegible]

Appendix D

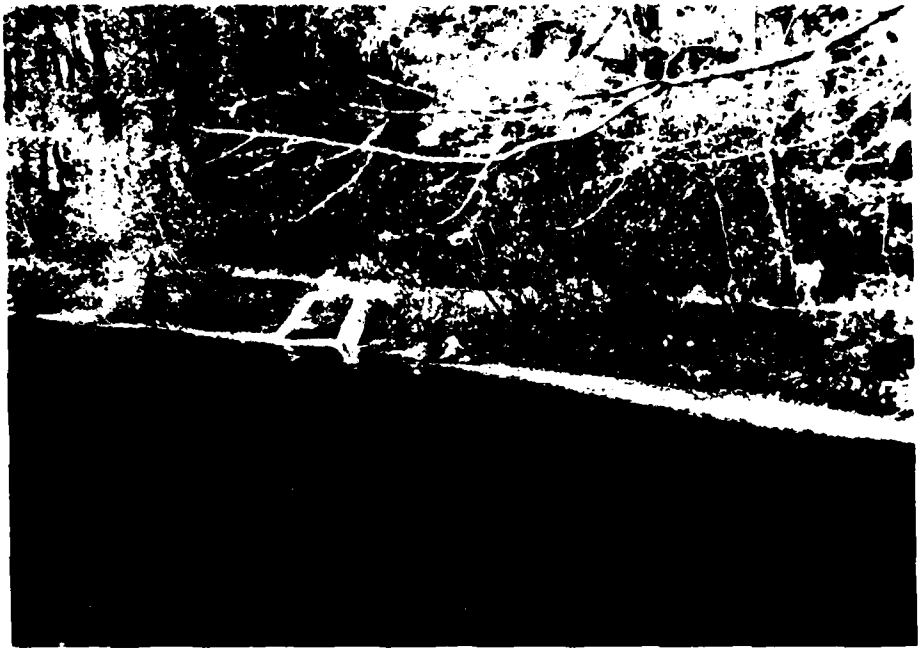
Hydrologic and Hydraulic Computations

13. Extensive erosion on upstream slope of Dike A at abandoned outlet structure.

14. Erosion along crest of Dike A

11. View along crest and downstream slope of Dike B.

12. Upstream slope of Dike B - Note concrete wall in center of photograph.



9. Upstream slope of Dike A.

10. Downstream slope of Dike A.

7. Downstream face of spillway

8. Deteriorated downstream spillway training wall and low level outlet.

5. Saddle on right reservoir rim.

6. Upstream view of concrete spillway and siphon spillway.

3. Boulders on upstream slope of left dam embankment.

4. Downstream slope of left dam embankment - note concrete wall just beyond the tree in foreground.

1. View of trees and boulders on upstream slope of dam.

2. View along crest of dam.

LOUIS BERGER & ASSOC., INC WELLESLEY, MASS. ARCHITECT · ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

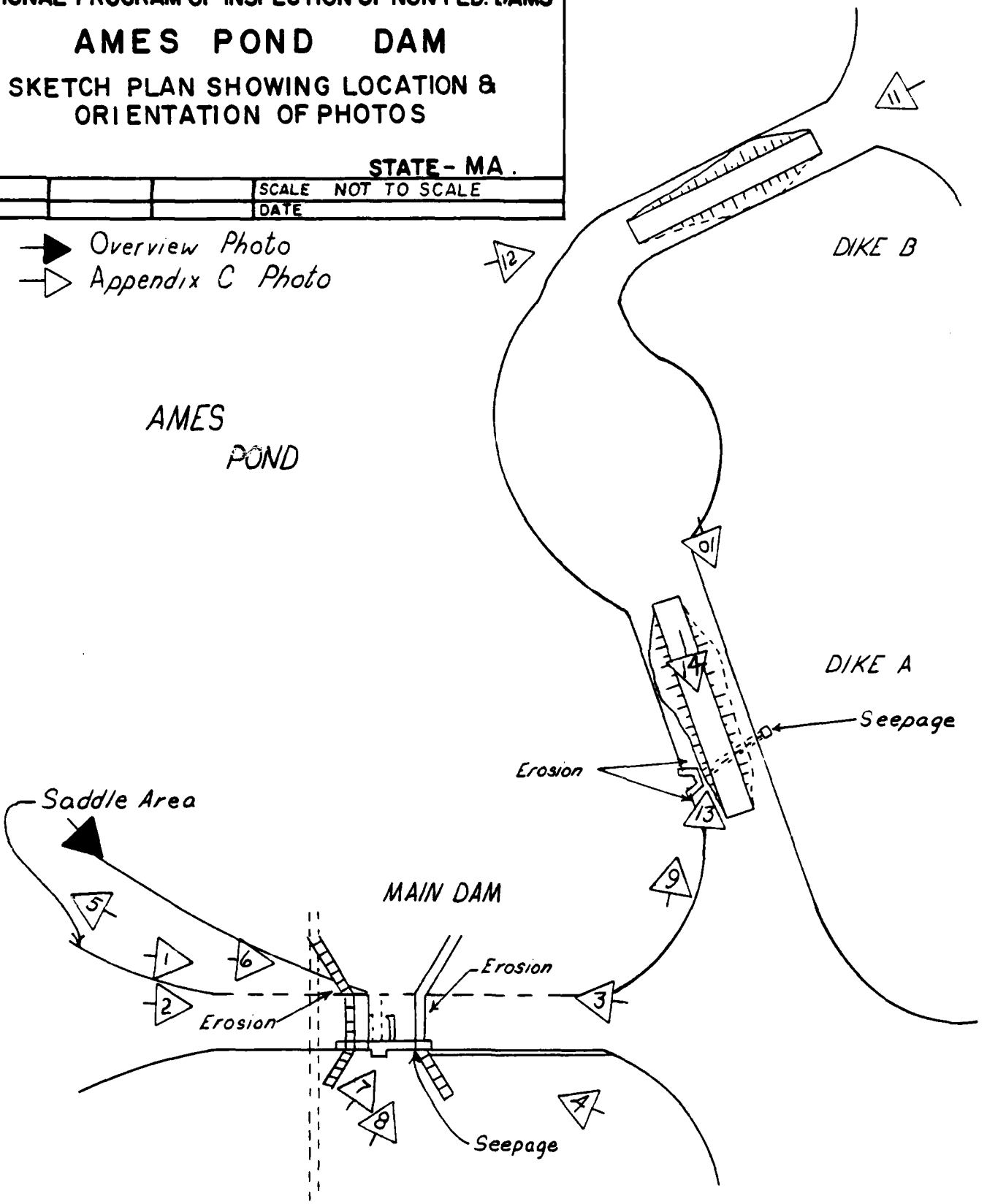
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

AMES POND DAM

SKETCH PLAN SHOWING LOCATION & ORIENTATION OF PHOTOS

STATE - MA.

SCALE	NOT TO SCALE
DATE	



Appendix C

Photos

Hydraulic Conditions (Continued)

A look at the sections taken through the dam indicate that a large amount of siltation has taken place behind the dam over the years. The pond bottom is now at the level of the spillway with the water being only 5' deep at a distance of 100' from the dam. This siltation has the effect of making the dam more hydraulically tight. It also adds to the structural stability of the earth fill portion of the dam. The soil does place a greater lateral load on the concrete portion of the dam than the water would alone.

The Conservation Commission asked my client to prove that the dam is safe now and that is will be safe in the future. The current situation looks much worse than it is. The cracked concrete portion of the dam does need some work to improve on its appearance and to insure its long term stability. There is little danger of imminent failure due to the shape of the dam and the cracked blocks of concrete. There is less of a chance for a major leak forming in the dam since the cracks would open, or wear, only very slowly and as such would not result in a rapid increase in seepage.

Proposed Remedial Work

1. The down stream face of the spillway should be sand blasted clean.

2. An epoxy cement should be injected through pre-drilled holes to seal the concrete both structurally and hydraulically. The 18" pipe shall be filled with concrete.

3. After the dam has been sealed, a back-up dam structure shall be placed behind (down-stream side) the existing dam. The details of reinforcement thickness of concrete and dimensions are shown on the the attached plan.

With the recommended changes, the structural and hydraulic integrity of the dam will be restored to its original, or better, condition. My client is willing to undertake the proposed dam repair if it is made a condition of approval by the Conservation Commission.

MERRIMACK ENGINEERING SERVICES • 66 MAIN STREET • ANDOVER, MASSACHUSETTS 01810

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Associate
STEPHEN E. STAPINSKI Tel. 374-9950

SURVEY OF THE EARTH AND CONCRETE DAM LOCATED ON AMES POND

At the request of the Conservation Commission, we have prepared this report on the Structural and Hydraulic Safety of the Subject Dam. The Topography of the dam along with its dimensions are shown on the attached plan which is made a part of this report.

History - The dam was built as a part of the Ames Estate around the turn of the century. The pond was originally used for sport fishing. The dam was constructed of earth fill with a central concrete spillway section. The spillway section had the capacity to receive flood boards which could raise the water level in the pond from elevation 147.01 (The top of the spillway) to elevation 149.7(The top of the dam). In the 1960's, a siphon was installed which was used to keep the level in the pond down so that the hydraulic load on the dam would be minimized. During the period of our survey, the top of the spillway was dry. That is, no water was flowing over the spillway. The only water leaving the dam area was through a crack in the dam.

Structural Condition

The earth fill is in good structural condition. No water appears to be permeating through the earth or cracks in the earth.

The concrete spillway section of the dam is crossed by many cracks. The main crack runs horizontally. It is through this crack that water is passing. Other cracks exist in the wing walls and just below the spillway section. Some of these cracks have opened up to widths of 1". (None of these are leaking). Other cracks are opened to lesser widths. There does not appear to be any lateral displacement of concrete portions of the dam.

Hydraulic Conditions

The earth fill portion of the dam is hydraulically tight. The concrete portion is leaking as indicated above. An estimate of the leakage is hard to determine at this time. I would estimate, based upon the stream flow below the dam that it is less than 1 CFS.

After Development Discharge

Q_{10} = .362 (3.3)940 = 1122CFS

Q_{25} = .362 (4.2)940 = 1429CFS

Q_{50} = .362 (4.8) 940 = 1633CFS

Percentage Difference 10 Year = 1.63%
Percentage Difference 25 Year = 1.63%
Percentage Difference 50 Year = 1.63%

Conclusion

The increment in runoff to Ames Pond as a result of the development of the 66 lot subdivision amount to 1.63% or .0163 of the total flow into Ames Pond in the 10, 25 and 50 year storm. We would respectfully submit that this increase is minimal and that no significantly larger increase in runoff is to be expected. We would also submit that the quality of the water in Ames Pond will not be adversely effected by the proposed sub-division.

MERRIMACK ENGINEERING SERVICES • 66 MAIN STREET • ANDOVER, MASSACHUSETTS 01810

BY KTB DATE 10-28-86 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF 2

CHKD. BY _____ DATE _____ PROJECT _____

SUBJECT AMES P[illegible] HYDROLOGY

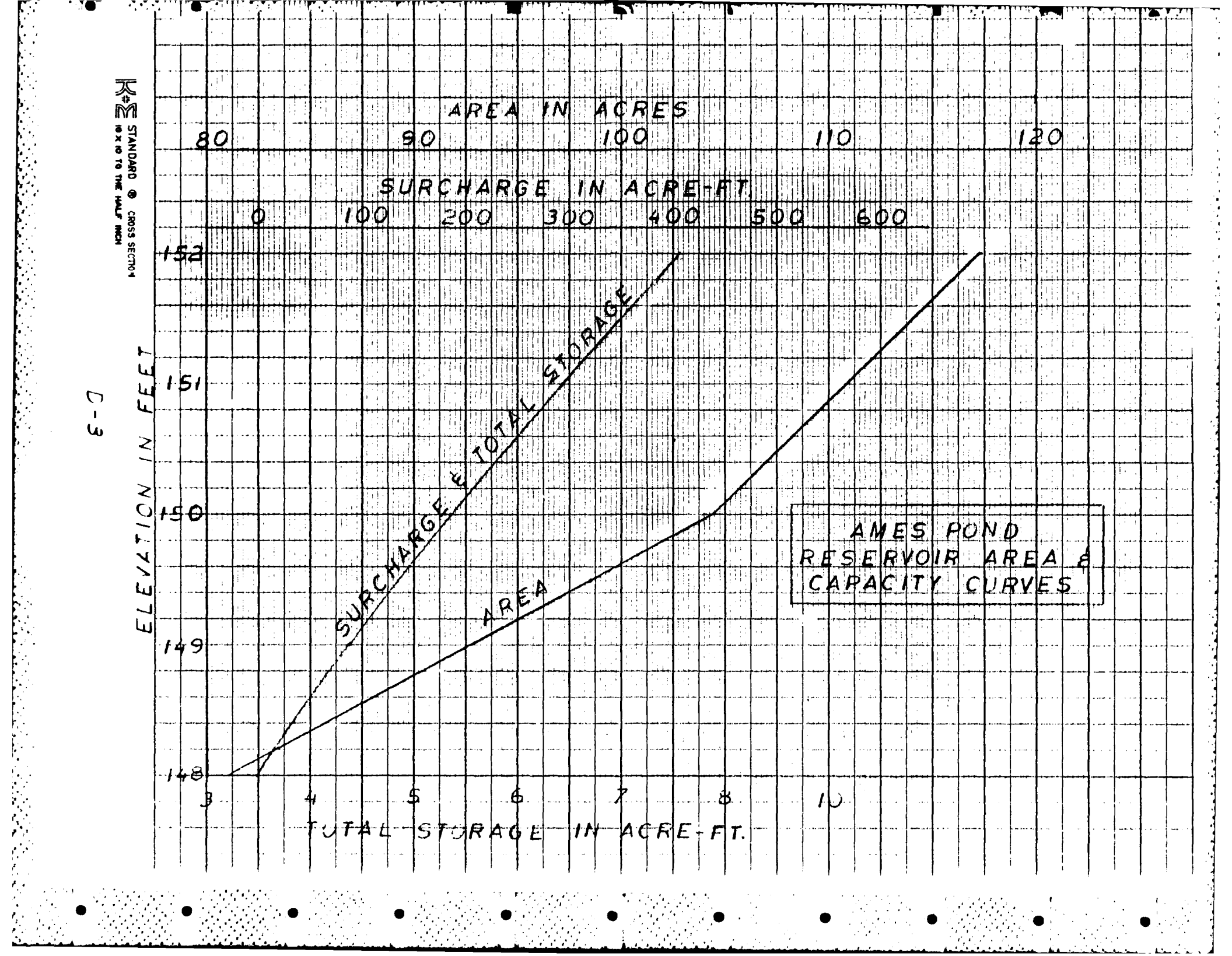
ESTIMATE STORAGE AT ELEV. 148

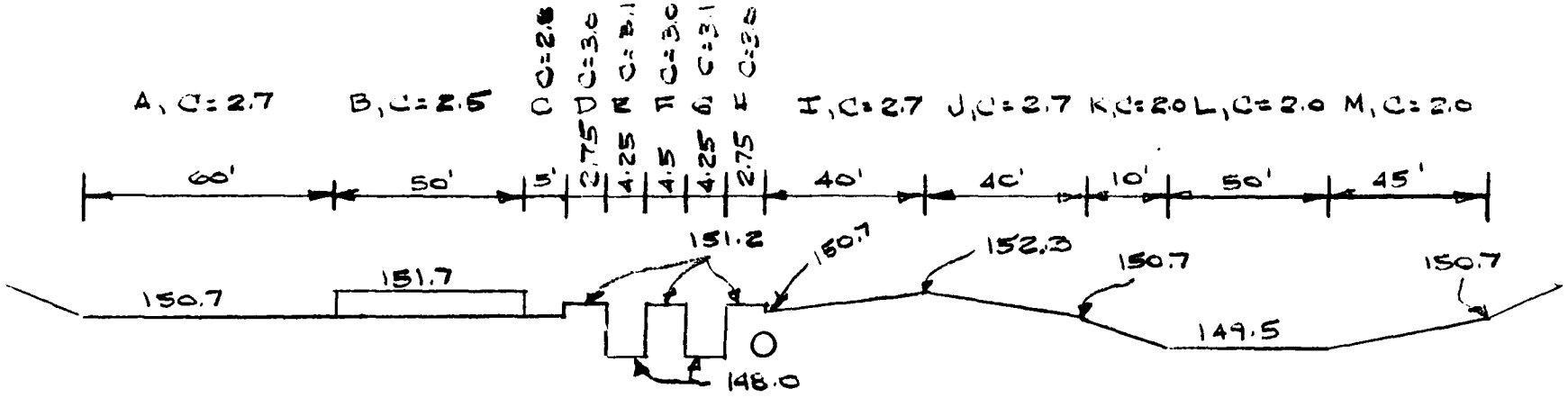
VOLUME = 1/2 h A = 1/2 (85)(81) = 344 A.F.

h = HEIGHT OF DIKE BELOW [illegible]

SAY NORMAL STORAGE = 350 A.F.

ELEV.	AREA	AVE AREA	ΔH	Δ STORAGE	TOTAL [illegible]	STORAGE [illegible]
148	81				350	
149	92.5	86.8	1	87	437	87
150	104	98.2	1	98	535	185
151	110.7	107.4	1	107	642	292
152	117.4	114.0	1	114	756	406
153	124.1	121.0	1	121	877	527
154	130.8	127.4	1	127	1004	654
155	137.5	134.1	1	134	1138	788


AREA IN ACRES
80
90
100
110
120
SURCHARGE IN ACRE-FT.
0
100
200
300
400
500
600
ELEVATION IN FEET
152
151
150
149
148
SURCHARGE & TOTAL STORAGE
AREA
AMES POND
RESERVOIR AREA &
CAPACITY CURVES
3
4
5
6
7
8
10
TOTAL STORAGE IN ACRE-FT.
KE STANDARD © CROSS SECTION
10 X 10 TO THE HALF INCH



ELEV	A		B		C		D, F, H			I, J,			K		
FT	H	Q	H	Q	H	Q	H	L	Q	H	L	Q	H	L	Q
150.7	0	0	0	0	0	0	0	0	0	0	0	0	0.6	10	9
151.2	0.5	57	0	0	0.5	5	0	0	0	.25	25	8	1.1	10	23
151.7	1	162	0	0	1	14	0.5	10	11	.5	50	48	1.6	10	40
152.3	1.6	328	0.6	68	1.6	28	1.1	10	35	0.8	80	155	2.2	10	65

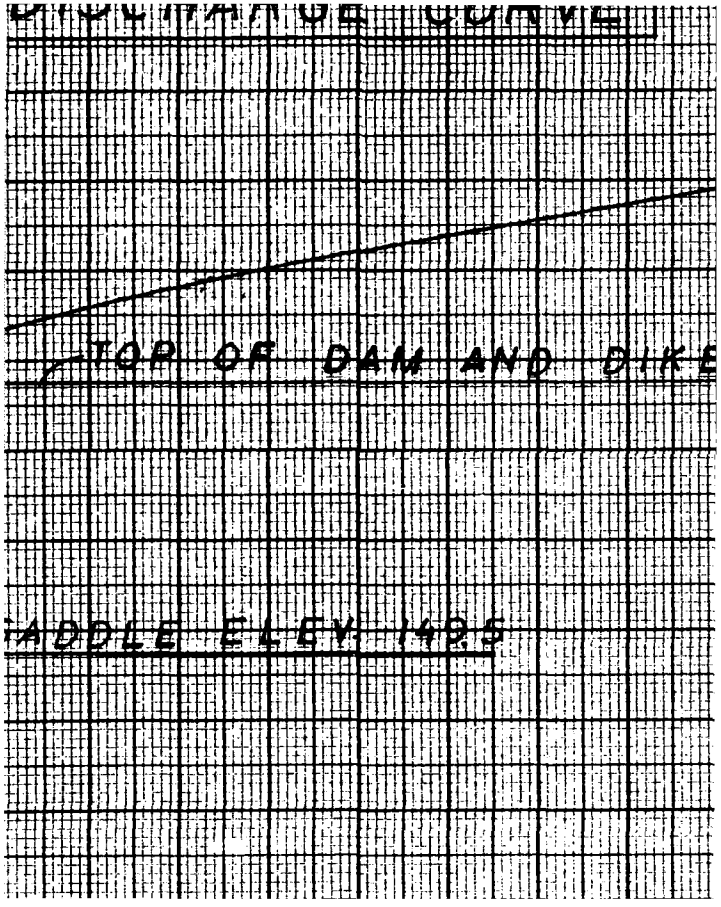
ELEV	E, F		L		M			SIPHON-12"D Q, C=.65		DIKE C=2.4		
FT	H	Q	H	Q	H	L	Q	H_T	$CA\sqrt{2gH_T}$	H	L	Q
149	1	26	0	0	0	0	0	10	13	0	210	0
149.5	1.5	48	0	0	0	0	0	10.5	13	0		0
150.7	2.7	117	1.2	131	0.6	45	42	11.7	14	0		0
151.2	3.2	151	1.7	223	1.1	45	104	12.2	14	0.5		215
151.7	3.7	188	2.2	326	1.6	45	162	12.7	15	1		610
152.3	4.3	235	2.8	469	2.2	45	294	13.3	15	1.6		1232

BY RFB DATE 10-29-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF 2

CHKD. BY _____ DATE _____ PROJECT W-196

SUBJECT AMES POND DAM DISCHARGE CURVE

ELEV	ΣQ	SPILLWAY Q's
148	0	0
149	39	39
149.5	61	61
150.7	313	131
151.2	800	165
151.7	1596	203
152.3	2914	250


TOP OF DAM AND DIKE
PADDLE ELEV. 1425

BY RFB DATE 10-21-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF 3

CHKD. BY DATE PROJECT W-198

SUBJECT AMES POND INFLOW HYDROGRAPH

DRAINAGE AREA (TOTAL) = 1.58 SQ. MI = 1011 ACRES

RESERVOIR AREA = 81 ACRES < 25% D.A.

LENGTH OF LONGEST WATER COURSE, L = 12,800 FT
L = 2.42 MI

Δ ELEV. DIFFERENCE = 260 - 148 = 112 FT

$\therefore$ SLOPE = $\frac{112}{2.42}$ = 46.3 FT/MI $\frac{1}{\sqrt{S}}$ = 6.80

NOW $\frac{LL_c}{\sqrt{S}} = \frac{(2.42)(2.42)}{6.8(2)} = 0.431$

$\left(\frac{LL_c}{\sqrt{S}}\right)^{.33} = (0.431)^{.33} = 0.758$

$LAG = K\left(\frac{LL_c}{\sqrt{S}}\right)^{.33} = 0.758K$

ASSUME K = 7.5 HRS REFER TO "CURVE B" MOUNTAINOUS REGION, MIXED TERRAIN, B OF REC

LAG = 7.5 (0.758) = 5.68 HRS

T_p = 0.41D + 0.82 LAG, WHERE D = 1.0 HRS

$T_p = 0.41(1) + 0.82(5.68)$

$T_p = 0.41 + 4.66 = 5.07$ HRS

CHECK VELOCITY $T_c = \frac{T_p - 0.5D}{0.6}$

$T_c = \frac{5.07 - 0.5}{0.6} = 7.62$ HRS

$V = \frac{12,800}{7.62(3600)} = 0.47$ FT/SEC O.K

$T_R = 1.67\, T_p = 1.67\,(5.07) = 8.47$ HRS

$T_B = T_p + T_B = 5.07 + 8.47 = 13.54$ HRS

---

q_p = PEAK RATE IN CFS

$q_p = \dfrac{484\, A\, Q}{T_p}$ A = DRAINAGE AREA
Q = RUNOFF IN INCHES

$q_p = \dfrac{484\,(1.58)\,(1)}{5.07} = 151$ CFS

PMP = PROABLE MAXIMUM PRECIPITATION

= $24.75\,(0.8) = 19.8''$

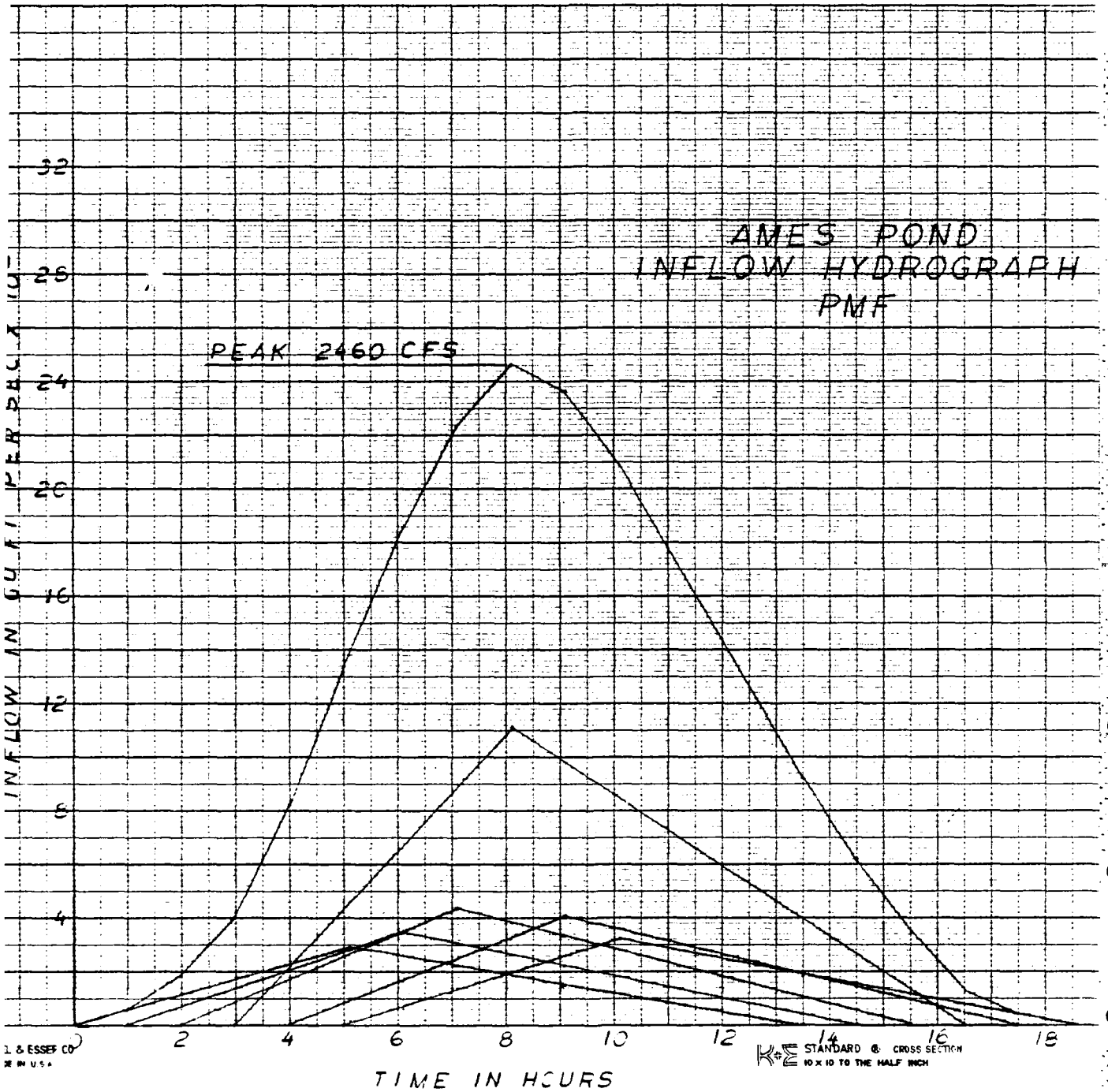
= $19.4''$ CONSIDERING INFILTRATION FOR OVERLAND FLOW.

FLOOD HYDROGRAPH FOR PMF

q_p = 151 cfs

TIME (HOURS)	RAINFALL		Q_p	TIME		
	*%	INCHES	CFS	BEGIN	PEAK	END
0.0	-					
1.0	10	1.94	293	0	5.07	13.54
2.0	12	2.33	352	1.0	6.07	14.54
3.0	15	2.91	439	2.0	7.07	15.54
4.0	38	7.37	1113	3.0	8.07	16.54
5.0	14	2.72	411	4.0	9.07	17.54
6.0	11	2.13	322	5.0	10.07	18.54

* DISTRIBUTION OF MAXIMUM 6 HOUR PMP IN PERCENT OF 6 HOUR AMOUNT PER EM 1110-2-1411


AMES POND
INFLOW HYDROGRAPH
PMF
PEAK 2460 CFS
INFLOW IN CUBIC FEET PER SECOND
32
28
24
20
16
12
8
4
2
4
6
8
10
12
14
16
18
TIME IN HOURS

D-10

DRAINAGE AREA = 1.58 sq.mi = 1011 ACRES

HEIGHT FROM CREST SADDLE TO STREAMBED = 8.5 FT

STORAGE @ ELEV. 149.5 = 485 ACRE-FT

SIZE CLASSIFICATION: SMALL

HAZARD CLASSIFICATION: HIGH

OCE GUIDELINES, USE 1/2 PMF to PMF

USE 1/2 PMF

FROM INFLOW HYDROGRAPH ∴ PMF = 2,460 CFS

TEST FLOOD = 1/2 PMF = 1230 CFS

STEP 1: Q_{P1} = 1,230 CFS

STEP 2a: ELEV. = 151.51

STEP 2b: SURCHARGE VOLUME = 350 A.F

$$\text{INCHS RUNOFF} = \frac{350 \text{ AF}}{1011 \text{ ACRES}} \times 12 \text{ IN/FT} = 4.15 \text{ IN.}$$

STEP 2a: $Q_{P2} = 1{,}230 \left(1 - \frac{4.15}{9.5}\right)$

Q_{P2} = 693 CFS

STEP 3a: FOR Q = 693

SURCHARGE HEIGHT = 151.12

SURCHARGE VOLUME = 306 A.F.

$$\text{INCHS RUNOFF} = \frac{306 \text{ A.F.}}{1011 \text{ ACRES}} \times 12 \text{ IN/FT} = 3.63 \text{ IN.}$$

STEP 3b

$$\text{AVE STORAGE} = \frac{4.15 + 3.63}{2} = 3.89 \text{ INS}$$

2ND ITERATION

STEP 2c $Q_{p2} = 1230\left(1 - \frac{3.89}{9.5}\right)$

$Q_{p2} = 726$

STEP 3a FOR Q = 726

SURCHARGE HEIGHT = 151.15

SURCHARGE VOLUME = 310 A.F.

$$\text{INCHS RUNOFF} = \frac{310 \times 12}{1011} = 3.68$$

$$\frac{\text{STOR 1} + \text{STOR 2}}{2} = \frac{3.89 + 3.68}{2} = 3.785$$

3RD ITERATION

STEP 2c $Q_{p2} = 1230\left(1 - \frac{3.785}{9.5}\right)$

$Q_{p2} = 740$ CFS

REP 3C FOR Q = 740

SURCHARGE HEIGHT = 151.16

SURCHARGE VOLUME = 310

INCHES RUNOFF = $\frac{310 \times 12}{1011} = 3.68$ IN

$\frac{\text{STOR 1} + \text{STOR 2}}{2} = \frac{3.78 + 3.68}{2} = 3.73$

AVE SURCHARGE VOLUME = $\frac{3.73 \times 1011}{12} = 314$ AF

SURCHARGE HEIGHT = 151.20

Q_{P3} = 790 CFS

1/2 PMF OVERTOPS SADDLE CREST BY 151.20 − 149.50 = 1.70
SAY 1.7 FT

1/2 PMF OVERTOPS DAM WALL & DIKE BY 151.20 − 150.70 = 0.50
SAY 0.5 FT

Q_o = 790 CFS

DATE 10-29-80 LOUIS BERGER & ASSOCIATES INC. SHEET NO. 1 OF 9

DATE PROJECT W-1123

AMES POND DAM + DOWNSTREAM AREA

DAM FAILURE

STEP 1: ASSUME FAILURE WHEN WATER LEVEL AT LOW POINT IN RIGHT ABUTMENT. ELEV. 149.5

STORAGE = 485 A.F.

HEIGHT = 8.5

LENGTH AT MIDHEIGHT = 115 FT

W = 40% OF 115 = 46 FT

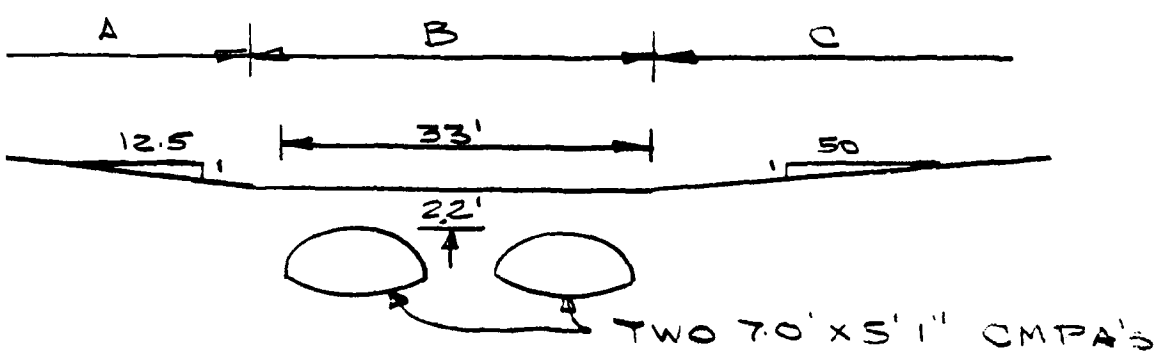
$Q_{P_1} = 8/27\ W \sqrt{g}\ H^{3/2}$

$Q_{P_1} = 1.68(46)(8.5)^{3/2} = 1915$ CFS

ADD SPILLWAY FLOW @ Q = 61 CFS

SAY Q = 1975 CFS

REACH #1 - DAM TO KENDALL ST.
(NO SIGNIFICANT STORAGE)



KENDALL ST. CULVERT

DATE 10-29-90 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 2 OF 9

DATE PROJECT

DOWNSTREAM ANALYSIS

P = [illegible]		C = 0.10			C = 0.5		
HW/D*	Q	H	L	Q	H	L	Q
1.43	520	0		0			0
1.57	560	.35	8.5	4	.7	30	45
1.76	600	.85	21	36	1.7	33	183
1.86	640	1.1	28	71	2.2	33	264
1.96	660	1.35	34	117	2.7	33	306
2.06	680	1.6	40	178	3.2	33	472

C = 2.2			Q
H	L	Q	TOTAL
0		0	520
.35	35	16	628
.85	85	146	965
1.1	110	279	1214
1.35	135	465	1525
1.6	160	712	2042

$$\frac{1915-1525}{2042-1525} = \frac{X}{0.5}$$

$X = 0.4$

$HW = 10.4$

ΔH OVERROAD $= 10.4 - 7.3$

$\cong 3$

FLOODING KENDALL ST

1 HOUSE 2 FT

1 HOUSE 3 FT

1 HOUSE 3 FT

1 GARAGE 3 FT

ENDALL ST, TO PINNACLE ST, L = 5620

CH 2

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

$Q = 0.51\, A R^{2/3}$

$S = \frac{10}{7000} = .0014$

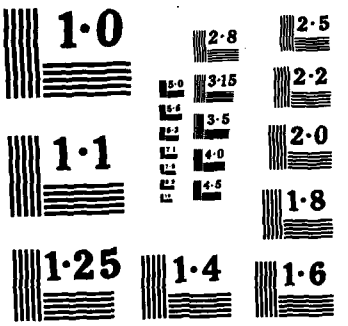
$S^{1/2} = .0378$

$n = 0.110$

AD-A155 808 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS AMES POND DAM (MA 010.. (U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV DEC 80 2/2

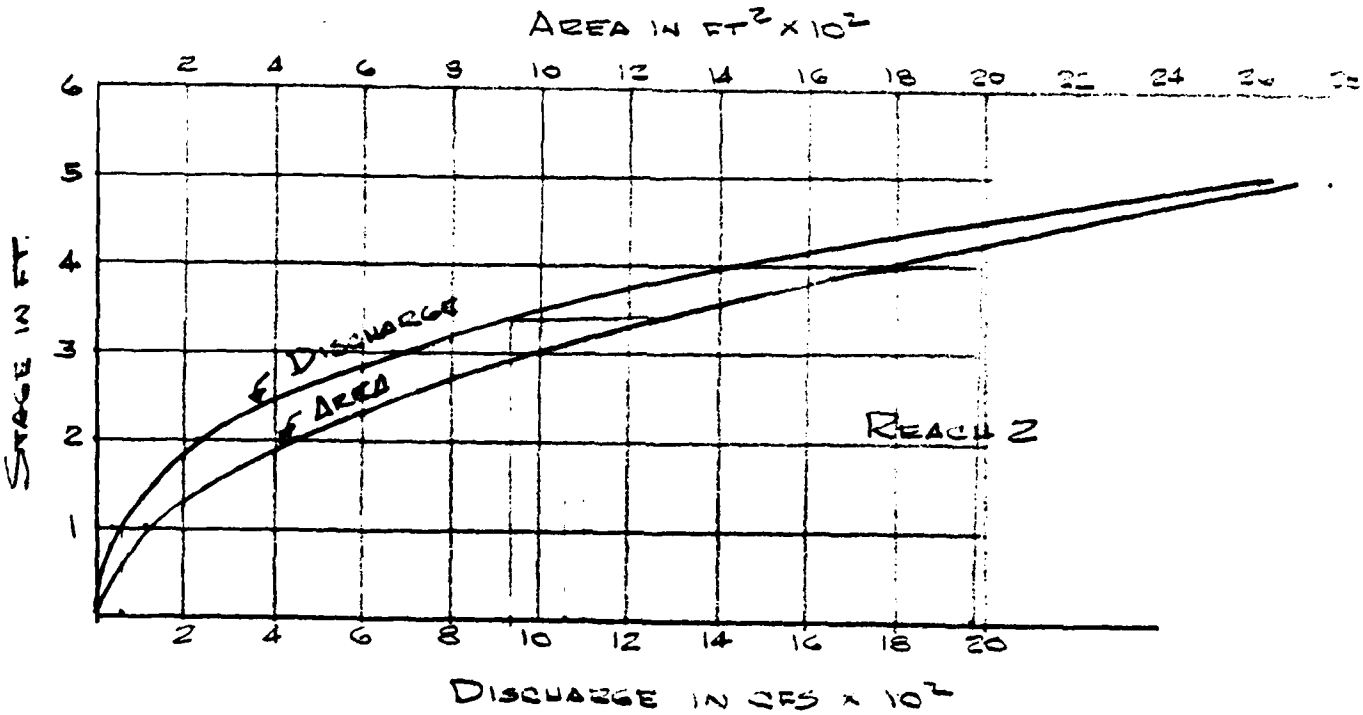
UNCLASSIFIED F/G 13/13 NL

END



NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

H	A	P	$R^{2/3}$	Q
1	114	228	0.63	36
2	448	448	1.0	228
3	1002	668	1.31	669
4	1776	888	1.59	1440
5	2770	1108	1.85	2613



FOR Q = 1975, STAGE = 4.5, AREA = 2200. □
Δ AREA = 2000

$$\Delta V_1 = \frac{2000 \times 5600}{43{,}560} = 257 \text{ A.F.}$$

$$Q_{P_2}(\text{TRIAL}) = 1975\left(1 - \frac{257}{485}\right)$$

$$= 930 \text{ CFS}$$

FOR Q = 930 , STAGE = 3.4, AREA = 1280

$\Delta A_2 = 1080$

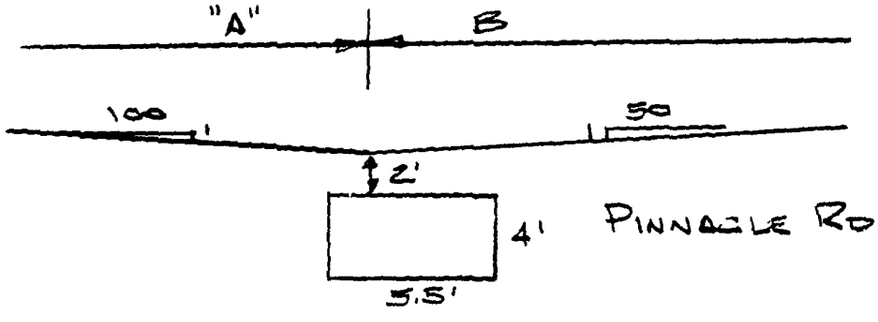
$$\Delta V_2 = \frac{1080 \times 5600}{43{,}560} = 139 \text{ A.F.}$$

$$V_{AVE} = \frac{257 + 139}{2} = 198 \text{ A.F.}$$

$$Q_{P2} = 1975 \left(1 - \frac{198}{485}\right)$$

$$Q_{P2} = 1170$$

Q @ PINNACLE RD 1170 CFS



PINNACLE RD CULVERT

H	HW/D	Q/B	Q	A, C=2.0			B, C=2.0		
				H	L	Q	H	L	Q
6	1.5	35	192	0			0		
7	1.75	39	214	0.5	100	70	0.5	50	35
8	2.0	44	242	1	200	400	1	100	200
8.5	2.12	48	265	1.25	250	698	1.25	125	350

@ 8.5 $Q_T = 1300$

ABOUT 2.5 FT FLOODING OVER ROAD

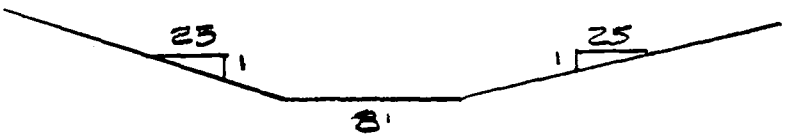
1 HOUSE = 2 FT FLOODING
1 COMMERCIAL = 1 FT FLOODING

REACH #3, PINNACLE RD TO [illegible], L = 6700

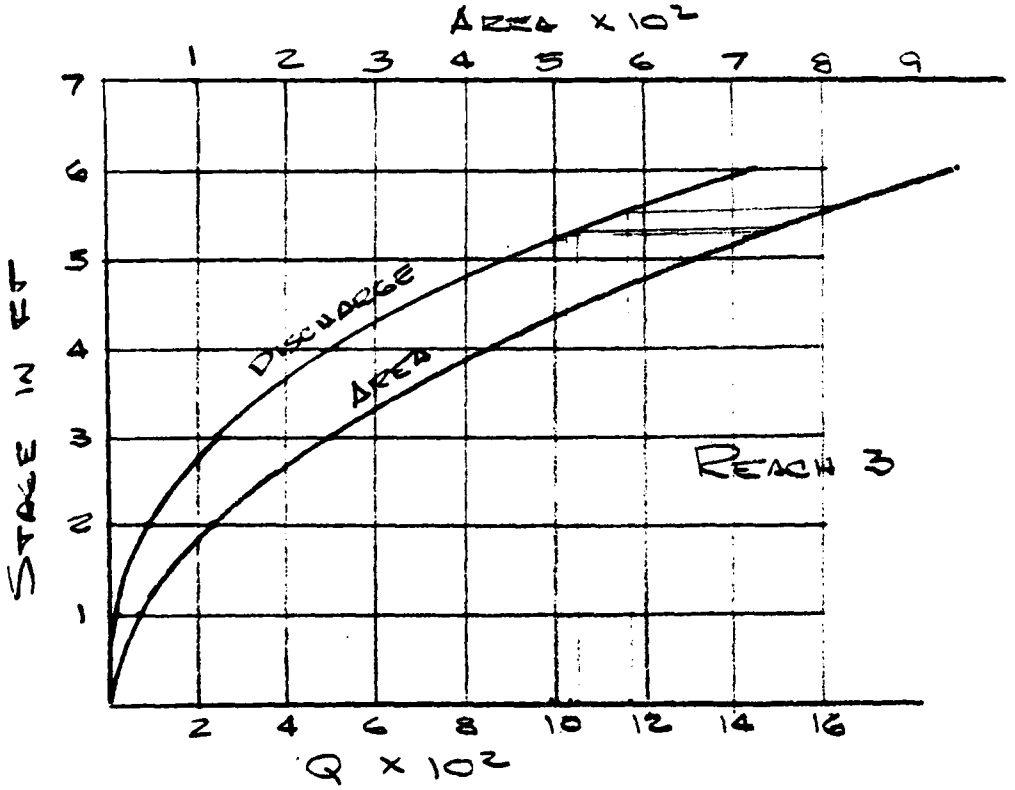
$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ $S = \frac{10}{6700} = .0015$

$Q = 0.72 A R^{2/3}$ $S^{1/2} = 0.034$

$n = .08$



H	A	P	$R^{2/3}$	Q
1	33	58	0.68	16
2	116	108	1.05	88
3	249	158	1.36	244
4	432	208	1.63	507
5	665	258	1.88	900
6	948	308	2.12	1447



REACH 3, FOR Q = 1170, STAGE = 5.5, AREA = 810

Δ AREA = 745

$$\Delta V_1 = \frac{745 \times 3000}{43{,}560} = 51 \text{ A.F.}$$

$$Q_{P2}\,(\text{TRIAL}) = 1170\left(1 - \frac{51}{485}\right)$$

$$" = 1050$$

FOR Q = 1050, STAGE = 5.3, AREA = 750

Δ AREA = 685

$$\Delta V_2 = \frac{685 \times 3000}{43{,}560} = 47 \text{ A.F}$$

AVE ΔV = 49 AF

$$Q_{P2} = 1170\left(1 - \frac{49}{485}\right) = 1050$$

BY INSPECTION EAST ST WILL FLOOD OVER BY ABOUT 3ET, BUT NO HOUSES FLOODED

REACH 4, EAST ST TO TEWKSBURY AIRPORT

L = 6100'

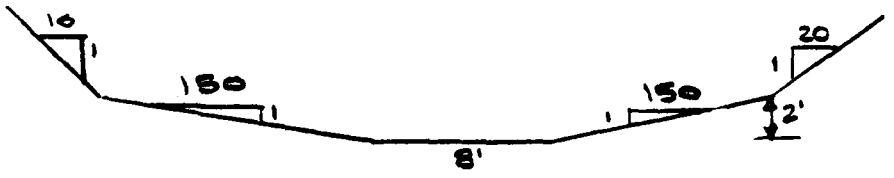
$S = \frac{10}{6700} = .0015$

$S^{1/2} = 0.039$

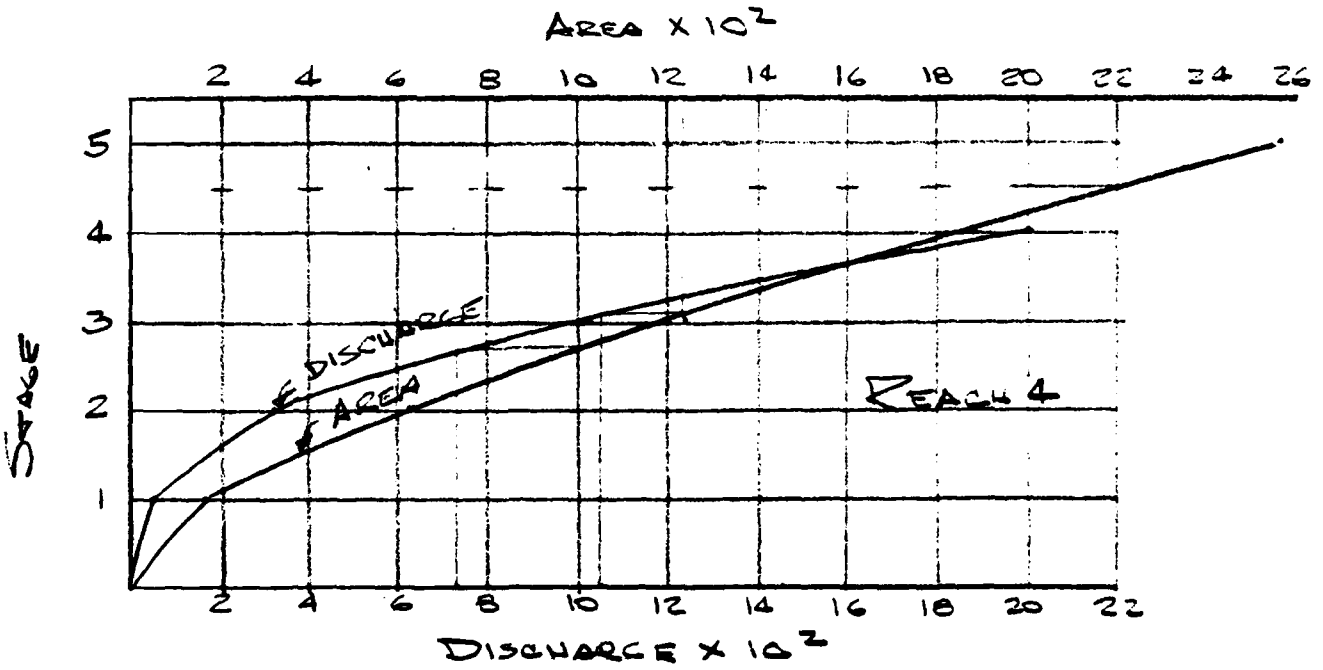
$n = 0.110$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = 0.53 A R^{2/3}$$



H	A	P	$R^{2/3}$	Q
1	158	308	0.64	53
2	616	608	1.00	326
3	1239	638	1.56	1024
4	1892	668	2.01	2015
5	2575	698	2.39	



FOR Q = 1050, STAGE = 3.1, AREA = 1230

Δ AREA = 1060

$$\Delta V_1 = \frac{1060 \times 6100}{43{,}560} = 148 \text{ A.F}$$

$$Q_{P2\,(TRIAL)} = 1050\left(1 - \frac{148}{485}\right)$$

$$= 730 \text{ CFS}$$

FOR Q = 730, STAGE = 2.6, AREA = 1000

Δ AREA = 830

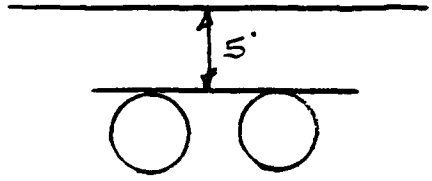
$$\Delta V_2 = \frac{830 \times 6100}{43{,}560} = 116$$

$$\Delta V_{AVE} = \frac{148 + 113}{2} = 130$$

$$Q_{P2} = 1050\left(1 - \frac{130}{485}\right)$$

$$Q_{P2} = 770 \text{ CFS}$$

NEWBURY AIRPORT CULVERTS



≈ TWIN 5' PIPES

H	HW/D	Q/PIPE	Q
10	2	300	600

SLIGHT OVERTOPPING

REACH 4, AIRPORT TO SHAWSHEEN ST., L = 2300

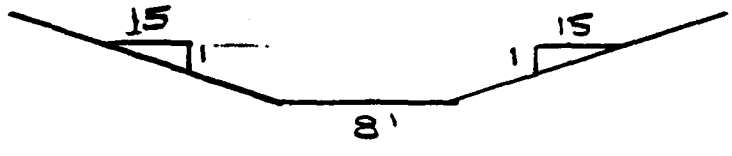
$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$Q = 0.96 A R^{2/3} S^{1/2}$$

$S = .0015$

$S^{1/2} = .039$

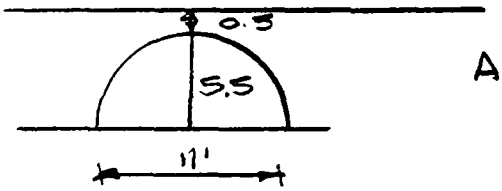
$n = 0.06$



H	A	P	$R^{2/3}$	Q
2	76	68	1.06	78
3	159	98	1.38	210
4	272	128	1.66	433
5	415	158	1.91	760
6	568	188	2.15	

FLOW @ SHAWSHEEN ST = 700 CFS

SEE IF SHAWSHEEN CULVERT WILL PASS 700 CFS.



$A = \frac{\pi (11)^2}{4} = 95 \text{ FT}^2$

$V = 700/95 = 7.38 \text{ FT/SEC}$

$h = 1.5 \frac{V^2}{2g} \approx 1.3$

SLIGHT OVERTOPPING OF ROAD

NO HOUSES FLOODED

BY REB DATE 10-30-80 **LOUIS BERGER & ASSOCIATES INC.** SHEET NO. 1 OF 2

CHKD. BY ____ DATE ____ PROJECT W-195

SUBJECT AMES POND DOWNSTREAM ANALYSIS

DIKE FAILURE

ASSUME DIKE FAILS WITH WATER ELEV 1507

STORAGE = 610 A.F.

LENGTH AT MIDHEIGHT = 80 FT, W = 32 FT

HEIGHT = 11.2 FT

$Q = 8/27\ W\sqrt{2g}\ H^{3/2}$

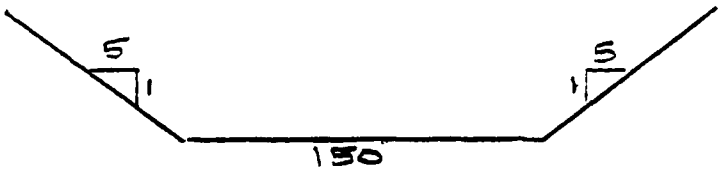
$Q = 1.68\ (32)(11.2)^{3/2}$

$Q = 2020$ CFS

NO SPILLWAY FLOW

ASSUME CRITICAL SECTION THRU HOUSING DEVELOPMENT JUST DOWNSTREAM

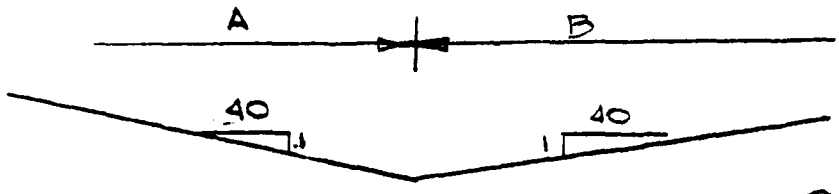
$$Q_c = \sqrt{\frac{A^3 g}{T}}$$



STORAGE INSIGNIFICANT

ELEV	DEPTH	TOP WIDTH	AREA	Q_c	V_c	h_{v_c}	$J+h_{v_c}$	W.S. ELEV.
125	0							
127	2	170	320	2491	7.8	.95	2.95	127.95

FLOODING 4 HOUSES - 2 TO 3 FT



$$Q_c = \sqrt{\frac{A^3 g}{T}}$$

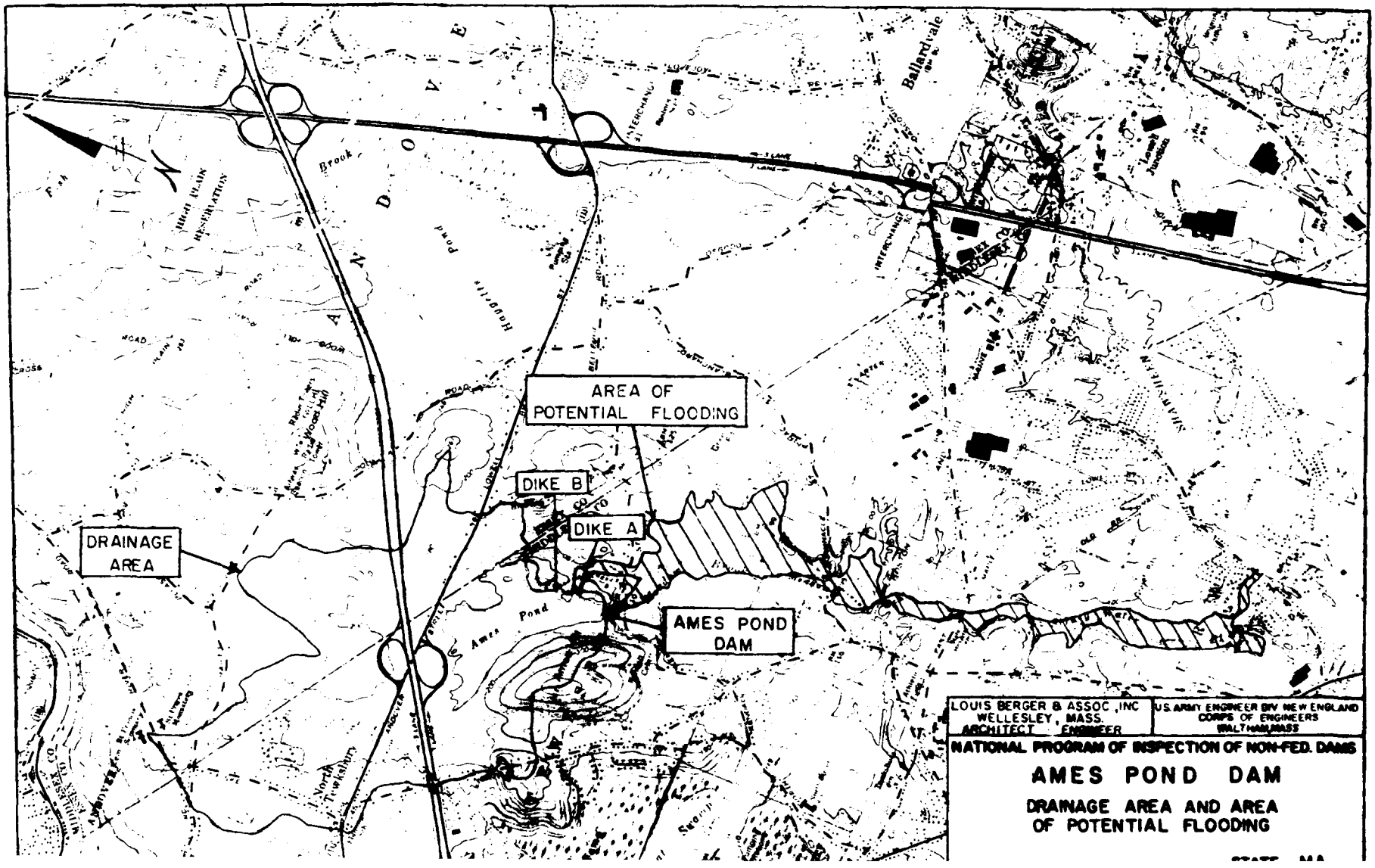
KENDALL ST.
ASSUME CRITICAL FLOW

STORAGE INSIGNIFANT

ELEV	DEPTH	TOP WIDTH	AREA	Qc	Vc	hvc	d+hvc	WS ELEV
100	0							
102	2	160	160	907	5.7	0.5	2.5	102.5
103	3	240	360	2501	6.9	0.7	3.7	103.7

FLOODING 4 HOUSES ABOUT 3.5 FT

BEYOND HERE FLOW RETURNS TO SAME VALLEY AS MAIN DAM BREACH DISCHARGE,


AREA OF
POTENTIAL FLOODING
DIKE B
DIKE A
DRAINAGE
AREA
AMES POND
DAM
Ballardvale
Ames Pond
North Tewksbury
LOUIS BERGER & ASSOC., INC
WELLESLEY, MASS.
ARCHITECT ENGINEER
U.S. ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS
AMES POND DAM
DRAINAGE AREA AND AREA
OF POTENTIAL FLOODING

Appendix E

Information as Contained in the

National Inventory of Dams

This Phase I Inspection Report on Ames Pond Dam and Dike has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

END

FILMED

8-85

DTIC